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All India Coordinated Research Project on Sugarcane

Project Coordinator's Report 2017-18

Dr S K Shukla

Project Coordinator

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ICAR-Indian Institute of Sugarcane Research
Lucknow - 226 002

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Preface

Sugarcane is the main source of raw material to Indian sugar and cottage jaggery industries and hence it is more pertinent in the present context of increasing farmers' income at the National level. A high yielding and high sugar variety compatible with remunerative inter-crops is important for increasing sugar production and farmers' income. The quick spread of improved sugarcane varieties developed under AICRP(S) and released through CVRC has sustained the cane and sugar yields, despite adverse agro-climatic conditions at different sugarcane growing zones. At present > 90% of area under sugarcane has been occupied by the improved varieties developed under AICRP on Sugarcane. As a result, the country has produced 376 mt sugarcane at productivity level of 79.65 t/ha from 4.73 m ha area. The concerted efforts *viz*. increased area under improved varieties, adoption of suitable agro-techniques and plant protection measures significantly contributed to elevate recovery up to 10.68% and sugar production by 32.15 mt which is the highest till now at the National level during 2017-18. It makes the country self-reliant in sugar production which is the sensitive essential commodity of mass consumption.

Ethanol production and co-generation of electricity in sugarcane factories are other sources of green energy production which further enhance the magnitude of sugarcane production in Indian economy. Diversified uses of sugarcane are pressing hard for its increased production from limited land resource under changing climatic scenario. In order to develop location specific high yielding sugarcane varieties with high sugar, zonal varietal trials of early and mid-late maturing varieties were conducted to screen the promising genotypes. In view of developing abiotic stress tolerant varieties due to climate change, identification & evaluation of ISH & IGH programme is being executed at identified centers for both drought as well as water-logging conditions. Total twenty nine (Early 14, Mid-late 13 and 2 trials combining early and mid-late maturity groups) varietal trials were conducted during the year 2017-18. A total of 47 entries in early group, 58 in mid-late group and 45 entries combining early and mid-late maturity groups were evaluated. In East Coast zone, CoC 13339 (Mid-late) and in North West zone, CoS 12232 (Mid-late) were identified as the qualifying entries based on the mean performance in two plant and one ratoon crops. Three sugarcane varieties *viz*., CoLk 11206 (Ikshu-4) an early maturing and CoLk 11203 (Ikshu-5) mid-late for north-west zone and CoA 11321 early maturing for East Coast Zone were identified for release by AICRP on Sugarcane & notified by CVRC in 2017.

To achieve desired growth in productivity and sugar recovery, the key issues like improving resource use efficiency, maintain soil organic carbon, biotic and abiotic stresses and location specific constraints need to be addressed. For developing effective and sustainable sugarcane production and reducing the expenses on costly inputs like irrigation water, chemical fertilizers and pesticides, emphasis has been given on holistic approach. Addition of 20 t/ha FYM/ compost along with inorganic fertilizers applied on the basis of soil test, soil test crop response for targeted yield or on the basis of general recommendation for the region has shown positive effect on sugarcane growth and yield both in plant and ratoon crops. Response of bio-fertilizers (*Azotobacter/ Acetobacter/ Azospirillum*/ PSB) was more pronounced in peninsular zone. Efficacy of Ethrel on accelerating and enhancing germination in sugarcane has been reported from almost all the centers and 50 ppm solution was found equally effective as 100 ppm. Spray of GA3 (35 ppm) during tillering enhanced cane yield effectively across the zones. Planting of sugarcane in paired rows (120: 30) with mulching of trash (6 t/ha) in the inter-row spaces out yielded the conventional flat method with or without mulch at all the centres in north western, north central and north eastern zones. Being in the climatic region of high evaporative demand, sugarcane crop responded up to 1.0 IW/CPE irrigation regime in the zones. However, similar yields have been recorded with 0.8 IW/CPE ratio at most of the centers. Trash mulching could effectively save 20-26% irrigation water over no-mulching.

Sugarcane crop in peninsular and east coast zones responded to furrow planting (120 cm) and skip furrow irrigation combined with the use of leguminous crop as green manure till 75 DAP, as mulch during tillering and thereafter residue incorporation. As far irrigation regimes, IW/CPE ratio 1.0 was resulted in higher cane productivity. However, it could be restricted to 0.8 for getting higher water use efficiency in these zones. Use of mulch in sub-tropical zones and green manuring followed by mulching and residue incorporation resulted in higher net return in tropical zones. In the north-west

zone, use of sugarcane trash as mulch with or without *Trichoderma* inoculation in the ratoon crop resulted in highest sugarcane equivalent yield with improvement in soil health indicators. Trash mulching along with the use of *Trichoderma* in ratoon crop yielded in highest cane equivalent yield of the system comprising sugarcane- ratoon- cowpea/ greengram crops in peninsular and east-coast zones. For north central zone, ratavator operation after ratoon harvest followed by spray of *Trichoderma* resulted in highest cane equivalent yield in sugarcane –ratoon – wheat cropping system.

The plant protection which includes plant pathology and entomology goes simultaneously with varietal breeding. During 2017-18, twelve projects were operated under plant pathology discipline at 22 centres in all the five zones. Differential host studies were conducted at 12 centres in four zones with 84 new isolates along with designated pathotypes to identify variation in red rot pathotype. More number of variants have been isolated from the popular varieties such as Co 0238, CoJ 64, Co 89003, CoLk 8102, CoS 8436, CoSe 92423, CoV 09356, CoSe 95422, and CoC 24. The new isolates of *C. falcatum* behaved almost similar to the existing pathotypes with limited variations. However, there was possible emergence of new pathotypes from Co 0238, CoS 8436, Co 89003 and Co 94012. At fifteen centres, the zonal varietal screening experiments were carried out for red rot testing, smut, wilt and YLD resistance. The incidence of red rot was noticed in CoSe 95422, CoS 8436 and CoSe 92423. The smut incidence (1-5%) was observed at several locations mainly on CoSe 92423, CoS 88230, CoS 91269 and Co 0238. Incidence of GSD was also noticed in most of the fields surveyed (1-5 %) on sugarcane varieties *viz*., CoS 91269 (10-20 %) and Co 0238 (5-10 %). The incidence of Pokkah boeng was also observed significantly. Sporadic incidence of leaf scald was also recorded. In tropical region, the incidence of red rot disease in CoC 24 and Co 91017 with a severity range from 2 to 22 % was observed. Wilt disease was observed in Co 86032 and CoV 09356 (2 to 14 %) and yellow leaf disease was noticed in Co 86032 (5 to 25 %), PI 1401 (5 to 10 %), PI 001110 (5 to 10 %) and CoV 09356 (5 to 15 %).

Cotton Swab Nodal method has shown consistent reaction across the centres for red rot testing. Many centres also recorded YLD resistance in the ZVT entries. Apart from red rot which continue to occupy prime importance in traditional sugarcane growing areas, there was a growing importance of Pokkah Boeng and Smut in subtropical region. In tropical India, the severity of Yellow Leaf disease and Brown rust has been increased. Occurrence of YLD, wilt, rust, pokkah boeng and brown spot to varying proportions were recorded in different states of the country. YLD occurrence is reported from all the states especially in epidemic proportions in tropical region. The work on rust inoculation methods revealed that Leaf Whorl Inoculation method was ideal for disease development. Useful information has been generated on pokkah boeng epidemiology and management. Clean seed programme initiated after virus elimination through tissue culture technique combined with molecular diagnosis was found to be effective to rejuvenate degenerated sugarcane varieties and management of Yellow Leaf Disease. Sugarcane crop raised through clean seed nurseries recorded higher cane yields and low incidence of pests and diseases.

The high incidence of black bug, thrips, web mite, top borer, root borer, early shoot borer (ESB), army worm, white fly, internode borer, woolly aphid and mealy bug have been reported on various varieties in different zones. The maximum incidence of early shoot borer, stalk borer, pink borer, white fly and rusty plum aphid was observed in the months of May, November, April, August and July, respectively in different zones. A new insect spittle bug (*Poophilus costalis* (Walker) was observed on sugarcane leaves in A.P. The bio-agents, *Trichogramma chilonis, Stenobracon sp. Rhaconotus scrpophagae,Isotima javensis, Cotesia flavipes, Sturmiopsis inferens, Fulgoraecia melanoleuca, Cheiloneurus pyrillae, Tetrastichus pyrillae, and Beaveria bassiana* were found effective against various insect-pests in different zones. Mass multiplication of egg parasitoid, *Trichogramma chilonis, Eumicrosoma sp.;fungi, Beaveria brongniartii & Metarhizium anisopliae* and host, *Pyrilla perpusilla* in the laboratory and *Chrysoperla zastrowi* sillemi under field condition was done on different hosts.

AICRP on Sugarcane is also the nodal agency for conducting a DUS Testing Programme under the Protection of Plant Variety and Farmers Rights Authority at its two cooperating cenres- ICAR-Indian Institute of Sugarcane Research, Lucknow and ICAR-Sugarcane Breeding Institute, Coimbatore.

The salient research achievements of 2017-18 in Crop Improvement, Crop Production, Plant Pathology and Entomology disciplines are being presented in this report.

(S.K. Shukla)
Project Coordinator (Sugarcane)

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The 32nd Biennial Workshop of the AICRP on Sugarcane is a mandatory activity to review the ongoing research projects on sugarcane at all India level and formulate the need based research programme for the next crop season. We wish to express our gratitude to Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR for his kind approval for organizing the 32nd biennial workshop at the University of Agricultural Sciences, Bengaluru (Karnataka) on October 17-18, 2018.

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ABOUT THE ALL INDIA COORDINATED RESEARCH PROJECT ON SUGARCANE

All India Coordinated Research Project on Sugarcane is serving to the Nation by coordinating research work since 1970 through a network of sugarcane research stations of ICAR, State Agricultural Universities, State Govt. Departments and Non-Government Organizations. At present, there are 22 regular centres and 14 voluntary centres for conducting research and multi-location testing of varieties/technologies for wider adoption. The Project also provides forum to the researchers for deliberations on new varieties and making recommendations on crop production and protection technologies.

In order to provide fluff to the breeders, a National Hybridization Garden was established in 1972 at the Sugarcane Breeding Institute wherein all the parents so far identified for their specific characters are planted in separate plots and the breeders of the centers make use of it for crossing and fluff production. SBI, Coimbatore also extends facility for crossing work at the National Distant Hybridization Facility established at Agali (District Palakkad, Kerala).

The research programmes of the project are decided according to the mandate and objectives of the AICRP (S) .

Mandate

- Evaluation of locally adapted sugarcane varieties with improved yield and quality as well as resistance to biotic and abiotic stresses.
- Development of package of practices for higher sugarcane production.
- Development of low cost technologies for sugarcane production.
- Intensifying and extending the networking facility and information generation for transfer of technology to the farmers and sugar industry.

Objectives

- To coordinate multilocation testing of germplasm and advance breeding materials for evaluating appropriate region/location specific improved varieties.
- To organize and conduct strategic and applied research of inter-disciplinary nature for evolving appropriate region/location specific package of practices for crop production.
- To develop region or location specific strategies for integrated disease and pest management.
- Enhancement and maintenance of disease free nucleus seed material for distribution to the cooperating organizations.
- To disseminate generated information and technology.

As per the mandate, main emphasis is laid on the development of improved sugarcane varieties suitable for commercial cultivation under different agro-climatic conditions in the country. Under this programme, 115 sugarcane varieties have been developed and of these, 57 varieties have been released and notified by Central Varietal Release Committee (CVRC) for commercial cultivation. The improved sugarcane varieties are meant for high cane yield, sugar recovery and resistance against major insect- pest and diseases.

As regards to production technologies, optimization of planting geometry and suitable row spacing for mechanization (tropical zone), integrated nutrient management, economy in water use for irrigation by devising micro-irrigation technique (sub-surface drip), mulching in ratoon for water conservation and weed control, integrated weed management and integrated diseases and insect-pest management have been developed and tested under various locations. Introduction of FIRB method for wheat + sugarcane system has facilitated timely planting of sugarcane in the areas where wheat-sugarcane in sequential cropping was popular and due to delayed planting, yield of sugarcane was less. Evaluation of various intercrops for increasing farmers income, agro-techniques for multiple ratooning played pivotal role in increasing productivity and sustainability.

For the conduct of zonal varietal trials, following five zones have been identified in the country. At present 22 regular and 14 voluntary centers located at different zones are working under this project.

Launch of website of AICRP on Sugarcane

The All India Coordinated Research Project on Sugarcane has launched its website (http://iisr.nic.in/aicrp/index.htm) on 16th February 2018 during the 67th Foundation day of ICAR-IISR Lucknow. Dr R.K. Singh, ADG(CC), ICAR, New Delhi launched the AICRP(S) website . The AICRP(S) website encompasses ongoing projects, developed technologies and their impacts, identified / released & notified sugarcane varieties, technical programmes of the AICRP(S) and publications of the Books/Bulletins/ Research papers, etc. Detailed information on ongoing projects and AICRP(S) reports may be obtained through online access of website.

Agro-climatic Zones and location of centers (Regular):

A. North West Zone

1. PAU Regional Station, Faridkot - 151 203 (Punjab)
2. PAU Regional Research Station, Kapurthala – 144 601(Punjab)
3. U.P. Council of Sugarcane Research, Shahjahanpur – 242 001
4. G.B. Pant University of Agriculture & Technology, Pantnagar – 263 145, Distt. U.S. Nagar
5. Agricultural Research Station (SKRAU), Sriganganagar – 335 001 (Rajasthan)
6. Agricultural Research Station (AU), Ummedganj, P.B. No. 7, GPO – Nayapura, Kaithoon Road, Kota – 324 001 (Rajasthan)
7. ICAR-Indian Institute of Sugarcane Research, Rae Bareli Road, Lucknow – 226 002
8. Regional Research Station, (CCSHAU), Uchani – 132 001, Karnal (Haryana)

B. North Central Zone

9. Sugarcane Research Institute (RAU), Pusa – 848 125, Distt. Samastipur (Bihar)
10. Sugarcane Research Station, Bethuadahari – 741 126 Distt. Nadia (W.B.)

C. North Eastern Zone

11. Sugarcane Research Station (A.A.U.), Buralikson, P.O. Baruabamungaon – 785 618 Distt. Golaghat (Assam)

D. Peninsular Zone

12. ICAR-Sugarcane Breeding Institute, Coimbatore – 641 007 (T.N.)
13. Sugarcane Research Station(KAU), Kallungal, Thiruvalla – 689 101 (Kerala)
14. Zonal Agricultural Research Station(UAS), V.C. Farm, Mandya – 571 405 (Karnataka)
15. Regional Sugarcane & Jaggery Research Station (MPKV)., Kolhapur – 416 005
16. Agricultural Research Station (UAS), Sankeshwar – 591 314, Tal. Hukkeri, Belgaum Distt. (Karnataka)
17. Main Sugarcane Research Station (NAU), Navsari – 396 450 (Gujarat)
18. Zonal Agricultural Research Station (JNKVV), Powarkheda – 461 110, Distt. Hoshangabad (M.P.)
19. Sugarcane Research Station (MPKV), P.O. Padegaon Farm – 415 521 Distt. Satara (M.S.)

E. East Coast Zone

20. Sugarcane Research Station (OUA&T), Panipoila, Distt. Nayagarh – 752 070 (Odisha)
21. Regional Agril. Research Station (ANGRAU), Anakapalle – 531 001 (A.P.)
22. Sugarcane Research Station (TNAU), Cuddalore – 607 001 (T.N.)

Future thrust

- To develop suitable varieties for biotic and abiotic conditions.
- Evaluation of more germplasm under different agro-ecological conditions for introgression genes contributing resistance to diseases and insect-pests, abiotic stresses and physiological efficiency of the genotype.
- To develop sugarcane varieties having high productivity, photo insensitivity and resistance to pests and diseases using conventional breeding methods as well as bio-technological tools.
- To develop low cost agro-techniques and economising water by micro-irrigation systems *viz.*, drip/sub-surface drip irrigation including fertigation.
- Recently, a few minor diseases like rust, pokkah boeng and yellow leaf disease and insect-pests like white grub and mealy bug are becoming economically important. Suitable protection technologies and their management is required.
- Development of Eco-friendly management with bio-control technique to reduce use of hazardous chemical.

- **Staff position :** Since 01.04.2018

Sanctioned Strength	Sanctioned		Total (2+3)	No. of posts vacant		Total (5+6)
	At headquarter Lucknow	At AICRP (S) centres		At headquarter Lucknow	At AICRP (S) centres	
1	2	3	4	5	6	7
Scientific	04	44	48	-	-	-
Technical	04	44	48	01	-	01
Administrative	03	-	03	02	-	02
Skilled Supporting Staff	-	-	-	-	-	-
Total	11	88	99	03	-	03

1. CROP IMPROVEMENT

Crop improvement in sugarcane through varietal development holds the most important component in increasing sugarcane and sugar production per unit of area and time. At present, more than 90% of area under sugarcane is occupied by the varieties developed through AICRP (S) network and area under traditional varieties has gone down. During last five years, several sugarcane varieties *viz*., Co 0403, Co 06027, CoSnk 05103, CoSnk 05104 and Co 09004 for Peninsular Zone; Co 06030, CoA 08323, CoA 05323 and CoA 11321 for East Coast Zone and CoH 128, Co 0237, Co 05011, CoPK 05191, Co 05009, Co 09022, CoLk 11203 and CoLk 11206 for North West & Central Zones have been identified by AICRP (S) and notified by CVRC for commercial cultivation. The sugarcane productivity which has stuck at 70 t/ha since long back, could reach 79 .65 t/ha (IV advance estimates 2017-18). The higher acreage under new varieties has elevated sugar recovery from 10.03% to 10.68% during last five years in the country which contributed significantly for increased sugar production of 32.15 m t during 2017-18.

In addition, location specific requirement for resistance / tolerance to various biotic and abiotic stresses are being addressed adequately to increase the productivity in the problematic areas. A separate programme for 'Evaluation and identification of climate resilient ISH and IGH genetics stocks for both drought and water logging conditions is being implemented at 8 centres in Maharashtra, Andhra Pradesh, Bihar, Punjab and Haryana states. The technical programme for the crop season 2017-18 and other research activities include –

- Crossing programme and growing of seedlings from fluff
- B.II- Implementation of Varietal Trials
- B.III- Evaluation & Identification of Climate Resilient ISH and IGH genetics stocks for both drought and water logging conditions.
- Besides, seed multiplication of new varieties was carried out at the identified centres for quick dispersal of the seed cane.

Sugarcane breeders from twenty three sugarcane research stations made desired crosses at National Hybridization Garden functioning at ICAR-Sugarcane Breeding Institute, Coimbatore and crossed seeds (fluff) were sent to them for raising seedlings and identifying location specific varieties. Superior clones developed by the breeding centres of each zones were pooled and these common entries were evaluated in ZVT conducted by 39 sugarcane research stations located in five different agro-climatic zones. Under the ZVT, the clones were evaluated for one year in Initial Varietal Trial (IVT) and better performing clones are forwarded to Advanced Varietal Trials (AVT) for evaluation in two plant and one ratoon crops in two years. The qualifying entries are identified based on the performance for cane yield, juice quality and reaction to pest and diseases across the centres in each zone and proposed for identification in AICRP(S) workshop. The major activities under the crop improvement programmes of AICRP(S) during 2017-18 are summarized below.

Weather, pests and diseases situation

Normal rainfall was observed in many centres during the year 2017-18. The lowest rainfall was reported by Rudrur (525.93 mm) followed by Padegaon (552.9 mm) and the highest rainfall was received at Buralikson (1942.5 mm). Perumalapalle in peninsular zone recorded the maximum temperature of 43°C during May, 2017 and Muzzafarnagar in North West Zone recorded the lowest temperature (4.7°C) during January, 2018. No major disease was reported by the centres. Minor incidence of insect-pests like stem borer, shoot borer, top borer, stalk borer, root borer, plassey borer and other pest like mealy bug, pyrilla etc. were reported by centres. Sporadic incidence of Yellow Leaf Disease (Mandya, Pune and Padegaon), rust (Mandya and Padegaon), Pokkah boeng (Padegon) and red rot (Perumalapalle) were noticed. General condition of the trials was good during the period under report.

AICRP - Varietal Trials:

Zone	No. of centres	Participating centres	
		Fluff receiving and ZVT centres	ZVT - centres alone
Peninsular Zone	18	Rudrur, Perumalapalle, Navasari,Mandya, Sankeshwar, Padegaon, Pune, Powarkheda, Thiruvalla	Sameerwadi, Akola, Pravaranagar, Kolhapur, Basmathnagar, Pugalur, Coimbatore, Raipur, Sirugamani
East Coast Zone	5	Anakapalle,Vuyyuru, Cuddalore, Nayagarh	Nellikuppam
North West Zone	10	Faridkot, Lucknow, Shahjahanpur, Pantnagar, Uchani, Kapurthala	Muzaffarnagar, Karnal, Kota, Sriganganagar
North Central Zone	5	Motipur, Pusa, Seorahi, Bethuadahari	Gorakhpur
North Eastern Zone	1	Buralikson	-

B. II Zonal Varietal Trials

Trials conducted and the number of entries evaluated

A total of 29 Zonal Varietal Trials (14 in early, 13 in midlate and 2 trials combining early and midlate maturity groups) were conducted during the year 2017-18. There were 7 IVT and 22 AVT trials. A total of 47 entries in early group, 58 entries in midlate group and 45 entries combining both the maturity groups were evaluated. Of these 13 in early and 17 in midlate were promising. Details of the trials conducted, number of entries evaluated and the promising clones identified are given below.

Zone / Trials	No. of clones + standards		Promising clones	
	Early	Midlate	Early	Midlate
Peninsular Zone				
AVT II Plant	5 + 3	6 + 2	CoM 11082, Co 11004	CoM 11085, CoM 11086, Co 11009
AVT Ratoon	5 + 3	6 + 2	CoM 11082	-
Pooled analysis	5 + 3	6 + 2	CoM 11082	-
AVT I Plant	-	8 + 3	-	VSI 12121, CoM 12085, Co 12009
IVT	-	37 + 3	-	-
Total entries	**5**	**51**	**2**	**6**
AVT II Plant	5 + 2	4 + 2	CoC 13336, CoV 13356	CoA 12324, CoC 13339
AVT Ratoon	5 + 2	4 + 2	CoC 13336, CoV 13356	CoA 12324, CoC 13339
Pooled analysis	5 + 2	4 + 2	CoC 13336	CoC 13339
AVT I Plant	5 + 3	6 + 3	CoA 14321, CoC 14336	Co 13031, CoA 14323, PI 14377
IVT	4 + 2	5 + 3	CoV 15356	-
Total entries	**14**	**15**	**5**	**5**
North West Zone				
AVT II Plant	4 + 2	6 + 3	-	Co 12029, CoS 12232
AVT Ratoon	4 + 2	6 + 3	-	Co 12029, CoS 12232
Pooled Analysis	4 + 2	6 + 3	-	Co 12029, CoS 12232
AVT I Plant	3 + 2	5 + 4	Co 13034	CoH 13263, Co 13035, CoPant 13224
IVT	7 + 3	13 + 4	Co 14034	-
Total entries	**14**	**24**	**2**	**5**
North Central & North East Zone				
AVT II Plant	3 + 2	4 +2	CoLk 12207, CoSe 12451	CoLk 12209
AVT Ratoon	3 + 2	4 +2	-	-
Pooled Analysis	3 + 2	4 +2	-	CoLk 12209
AVT I Plant	3 + 3	-	CoSe 13451, CoSe 13452	-
IVT	8 + 3	9 + 3	-	-
Total Entries	**14**	**13**	**4**	**1**
Grand total (Entries)	**47**	**103**	**13**	**17**

*Common entries in II Plant, ratoon and pooled analysis.

Qualifying entries in different trials:

Zone	Trial	Entries
North West Zone	AVT - Midlate (2 Plant + 1 Ratoon)	CoS 12232
East Coast Zone	AVT - Midlate (2 Plant + 1 Ratoon)	CoC 13339

The entries recorded 10% improvement for cane yield and numerically superior/on par for juice sucrose % compared to the best standards or an entry which recorded 5% improvement for juice sucrose % and numerically superior/on par for cane yield were selected as qualifying entries which may be considered for identification. In East Coast zone, CoC 13339 (Midlate) and in North West zone CoS 12232 (Midlate) were identified as the qualifying entries based on the mean performance in two plant and one ratoon crops.

Fluff Supply Programme

National Hybridisation Garden (NHG) was planted with 607 parental clones during 2017-18. Flowering was delayed by more than 15 days and out of 607 parents, only 263 flowered. Per cent of clones flowered during 2017 was 43.33 % against 52.46 % during 2016 and 58.26 % during 2015.Twenty one centres participated in the crossing programme. The centers were facilitated to make 453 bi-parental crosses and 2 selfs at NHG at ICAR-SBI, Coimbatore. Besides bi-parental crosses, 8 poly crosses, 187 general collections of open pollinated fluff (GCs) were also made for these centers. Further, 12 centers were facilitated to effect 55 bi-parental crosses and 24 general collections at National Distant Hybridization Facility (NDHF) available at ICAR-SBIRC, Agali. Altogether 508 bi-parental test crosses, 2 selfs, 8 poly crosses and 211

Table 1: Crosses made by the participating centres and the fluff (g) despatched from NHG during 2017-18

Zone / Centre	NHG, ICAR-SBI, Coimbatore						NDHF, ICAR-SBI RC, Agali				Total quantity of fluff sent (g)
	Station crosses		Poly crosses		General collections		Station crosses		General collections		
	No.	Fluff weight (g)	No.	Fluff weight (g)	No.	Fluff weight (g)	No.	Fluff weight (g)	No.	Fluff weig ht (g)	
PENINSULAR ZONE	145	2743.5	3	140.0	62	1010.5	20	243.0	12	287.5	4424.5
EAST COAST ZONE	77	1279.0	3	51.5	56	823.5	3	47.5	6	72.0	2273.5
NORTH WEST ZONE	137	2642.5	5	202.0	169	3007.0	16	230.5	3	30.0	6112.0
NORTH CENTRAL ZONE	94	2201	5	101.0	80	1818.5	16	306.0	3	33.0	4459.5
Grand total	453	8866.0	8*	494.5	187*	6659.5	55	827.0	24	422.5	17269.5

*excluding duplicates

GCs were effected. Fluff weighing 17.26 kg of crosses made at NHG and NDHF during 2017 flowering season was supplied to the 23 participating centers of fluff supply programme (Fluff was supplied to Bethuadari and Buralikson centres on request).

Zone wise and centre wise crossing programme and seedling raising

North-West Zone

The centre wise relevant information is given in Table 2.

Kapurthala

The centre made 32 bi-parental, 5 poly crosses and 25 general cross during 2017-18 and received 1216.5 g of fluff. Of the 6250 seedlings planted, 3902 (76.32%) survived. Among different crosses, bi-parental crosses obtained maximum number of seedlings (5.87) per g of fluff while the average was worked out to be 5.14 seedlings/g of fluff.

Faridkot

In Faridkot, total 23 cross (bi-parental 2, poly 4 and general 17) were effected during 2017-18 and the centre received 932.5 g of fluff. Total 2072 seedlings were planted while 1571 (81.47%) survived. Among different crosses, bi-parental crosses obtained maximum number of seedlings (5.87) per g of fluff while the average was worked out to be 5.14 seedlings/g of fluff.

Shahjahanpur

The Shahjahanpur centre made 40 bi-parental, 5 poly crosses and 40 general cross during 2017-18 and received 1552 g of fluff. Of the 4032 seedlings planted, 3613 (89.61%) survived.

Lucknow

In Lucknow, total 87 crosses (bi-parental 40, poly 6, general 38 and selfs 3) were effected during 2017-18. Total

Table 2: North West Zone

Name of centre	Cross		Wt. of fluff sown (g)	No. of seedlings transplanted	No of seedlings obtained/ gm of fluff sown	No. of seedlings survived	% survival
	Type	No.					
Kapurthala	Bi-parental	32	698.5	4100	5.87	2653	79.15
	Poly	05	37.0	175	4.73	63	67.74
	General	25	481.0	1975	4.11	1186	71.10
	Total	**62**	**1216.5**	**6250**	**5.14**	**3902**	**76.32**
Faridkot	Bi-parental	02	11.50	80.0	6.0	37	10.00
	Poly	04	187.50	429.0	2.0	297	64.87
	General	17	733.50	1563.0	4.0	1237	79.33
	Total	**23**	**932.50**	**2072.0**	**0.88**	**1571**	**81.47**
Shahjahan-pur	Bi-parental	40	803	1861	0-15	1711	91.94
	Poly	05	30	16	0-20	13	81.25
	General	40	719	2155	0-40	1889	87.66
	Total	**85**	**1552**	**4032**	**0-40**	**3613**	**89.61**
North West Zone	Bi-parental	74	1513	6041.0	12.16	4401	72.85
	Poly	14	2545	620	2.44	373	60.16
	General	82	1933.5	5693	2.94	4312	75.74
	Total	**170**	**3701**	**1235.4**	**3.34**	**9086**	**73.55**

24429 seedlings were planted by Lucknow centre. In first clonal trial 225 clones were planted, while in second clonal trial 26 and in station trial 11 clones were evaluated. Five clones were selected for zonal varietal trial.

North Central & North East Zone

The centre wise relevant information is given in Table 3.

Pusa

There were total 73 crosses made by the Pusa centre comprising bi-parental 34, poly crosses 5 and general collection 34 during 2017-18. The centre received 1473.5 g of fluff. Of the 18515 seedlings planted, 11388 (61.51%) survived. Among different crosses, the maximum survival of the seedlings (71.4%) was observed in general cross. Bi-parental crosses obtained maximum number of seedlings (15.97) per g of fluff while the average was worked out to be 12.56 seedlings/g of fluff.

Bethuadahari

The Bethuadahari centre made bi-parental 5, poly crosses 01 and general cross 12 during 2017-18 and received 427.5 g of fluff. Of the 1803 seedlings planted, 1006 (55.8%) survived. Among different crosses, general crosses obtained maximum number of seedlings (4.95) per g of fluff while the average was worked out to be 4.21 seedlings/g of fluff.

Buralikson

Total 20 crosses were made by the Buralikson centre, comprising bi-parental 04 and general cross 16 during 2017-18. The centre received 478g of fluff. Of the 535 seedlings planted under general crosses, 327 (61.12%) survived. In general crosses, the centre obtained 1.13 seedlings per g of fluff.

Peninsular Zone

The centre wise relevant information is given in Table 4.

Padegaon

The centre effected total 65 crosses including station cross 44, poly crosses 7 and general cross 14 during 2017-18 and received 240 g of fluff. Of the 1323 seedlings planted, 998 (75.43%) survived. Among different crosses, poly crosses obtained maximum number of seedlings (23.98) per g of fluff while on an average 5.14 seedlings/g of fluff was recorded at Padegaon centre.

Navsari

Total 34 crosses were made by the Navsari centre, comprising station cross 18, poly crosses 3, general cross 10 and zonal crosses 3 during 2017-18. The centre received 4781.5 g of fluff. Of the 1339 total seedlings planted. 1254 (93.65%) survived. The centre observed an average 2.78 seedlings per g of fluff.

Perumalapalle

In Perumalapalle centre, total 49 crosses were made which comprised station cross 16, poly crosses 7, general cross 16 and zonal crosses 10 during 2017-18. The centre received 876 g of fluff. Of the 5137 total seedlings planted. 4349 (83.7%) survived. The centre observed an average 5.86 seedlings per g of fluff.

East Coast Zone:

The centre wise relevant information is given in Table 5.

Vuyyure

This centre effected total 24 crosses including station cross

Table 3. North Central & North Eastern Zones

Name of centre	Cross		Wt. of fluff sown (g)	No. of seedlings transplanted	No of seedlings obtained/ gm of fluff sown	No. of seedlings survived	% survival
	Type	No.					
Pusa	Bi-parental	34	802.0	12806	15.97	7316	57.13
	Poly	05	32.0	90	2.81	60	66.18
	General	34	639.5	5619	8.79	4012	71.40
	Total	**73**	**1473.5**	**18515**	**12.56**	**11388**	**61.51**
Bethua-dahari	Bi-parental	05	110.5	314	2.84	27	8.60
	Poly	01	22.0	27	1.22	4	14.81
	General	12	295.0	1462	4.95	975	66.70
	Total	**18**	**427.5**	**1803**	**4.21**	**1006**	**55.80**
Buralikson	Bi-parental	04	84.0	-	-	-	-
	General	16	394.0	535.0	1.16	**327**	**61.12**
	Total	**20**	**478.0**	**535.0**	**1.13**	**327**	**61.12**
North Central & Eastern Zones	Bi-parental	43	996.5	13120	13.17	7343	55.97
	Poly	06	54	117	2.17	64	54.70
	General	62	1328.5	7616	5.73	5314	69.77
	Total	**111**	**2379**	**20853**	**8.77**	**12721**	**61.0**

Table 4 : Peninsular Zone

Name of centre	Cross		Wt. of fluff sown (g)	No. of seedlings transplanted	No of seedlings obtained/ gm of fluff sown	No. of seedlings survived	% survival
	Type	No.					
Padegaon	Station	44	917.50	8181	8.92	5882	71.90
	Poly	07	46.50	1115	23.98	880	78.92
	General	14	240.00	1323	5.51	998	75.43
	Total	**65**	**1204.00**	**10619**	**8.82**	**7760**	**73.08**
Navsari	Station	18	280.0	986	3.52	923	93.61
	Poly	03	16.0	46	2.87	42	91.30
	General	10	134.50	238	1.77	224	94.11
	Zonal	03	51.0	69	1.35	65	94.20
	Total	**34**	**481.50**	**1339**	**2.78**	**1254**	**93.65**
Perumala-palle	Station	16	422.5	1323	3.13	1112	84.00
	Poly	07	94.50	720	7.62	571	79.3
	General	16	312.0	2213	7.09	1917	86.6
	Zonal	10	47.0	881	18.74	749	85.0
	Total	**49**	**876.0**	**5137**	**5.86**	**4349**	**83.7**
Thiruvalla	**Due to heavy flood occurred at SRS, Thiruvalla between 15 to 20 July, 2018, the fluff shown in the nursery has been completely lost.**						
Peninsular Zone	Station	78	1620.0	10490	6.47	7917	75.47
	Poly	17	157.0	1881	11.98	1493	79.37
	General	40	686.5	3774	5.50	3139	83.17
	Zonal	13	98.0	950	9.69	814	85.68
	Total	**148**	**2561.5**	**17095**	**6.67**	**13363**	**78.17**

Table 5 : East Coast Zone

Name of centre	Cross		Wt. of fluff sown (g)	No. of seedlings transplanted	No of seedlings obtained/ gm of fluff sown	No. of seedlings survived	% survival
	Type	No.					
Vuyyuru	Station	12	181.0	1903	10.51	924	48.55
	Poly	03	15.0	20	1.33	9	45.00
	General	09	94.5	281	2.97	89	31.67
	Total	**24**	**290.5**	**2204**	**7.59**	**1022**	**46.37**
Anakapalle	Station	30	807.50	4676	5.79	4218	90.21
	Poly	05	29.00	875	30.17	676	77.26
	General	07	46.5	450	9.67	379	84.22
	Total	**42**	**883.0**	**6001**	**6.79**	**5273**	**87.87**
East Coast Zone	Station	42	988.5	6579	6.66	5142	78.16
	Poly	08	44.0	895	20.34	685	76.54
	General	16	141.0	731	5.18	468	64.02
	Total	**66**	**1173.5**	**8205**	**6.99**	**6295**	**76.72**

12, poly crosses 3 and general cross 9 during 2017-18 and received 290.5 g of fluff. Of the 2204 seedlings planted, 1022 (46.37%) survived. Among different crosses, station cross obtained maximum number of seedlings (10.51) per g of fluff while on an average 7.59 seedlings/g of fluff were recorded at Vuyyure centre.

Anakapalle

In Anakapalle centre, total 42 crosses were made which comprised station cross 30, poly crosses 5 and general cross 7 during 2017-18. The centre received 883 g of fluff. Of the 6001 total seedlings planted 5273 (87.87%) survived. The centre observed an average 6.79 seedlings per g of fluff.

B. II Zonal Varietal Trial

North-west zone

North-west zone comprises ten centers *viz.* Faridkot, Karnal, Kota, Lucknow, Kapurthala, Mujaffarnagar, Pantnagar, Shahjahanpur, Sriganganagar and Uchani. Results of zonal varietal trials as assigned to these centers during 2017-18 on pooled analysis of data obtained from various centres are summarized here as under.

IVT (Early)

In IVT early group, 7 genotypes *viz* .Co 14034, Co 14201, CoLk 14202, CoPant 14222, CoPb 14181, CoPb 14182 and CoPb 14211 were evaluated with three standards CoJ 64, Co 0238 and Co 05009. The data revealed that the genotype **Co 14034** recorded the highest cane yield (95.19 t/ha) and CCS (11.5 t/ha) with comparable sucrose (17.31%) in juice against the best check Co 0238 which recorded cane yield, CCS and sucrose in juice as 88.99 t/ha, 10.88 t/ha and 17.62%, respectively (Table 6). Among other genotypes, **CoPb 14181** (91.84t/ha) and **CoPb 14211** (92.21) cane yields also recorded sucrose % in juice ranging 17.27 to 17.03%, being closer to the best check variety of Co 0238 (17.62%). The cane yield and quality attributes of these three clones were found to be consistently superior at three locations *viz*. Shahlahanpur, Kapurthala and Lucknow.

AVT Early Plant I

Three test clones *viz*. Co 13034, CoPb 13181 and CoS 13231 were evaluated against three standards CoJ 64, Co 0238 and Co 05009 for cane yields and quality traits. All the three test clones were statistically at par with high scoring standard Co 0238 (83.24 t/ha) for cane yield, sucrose % and CCS (t/ha). However, **Co 13034** recorded the highest cane yield (88.8t/ha), sucrose in juice (18.48%) and CCS (11.37 t/ha) (Table 6).

AVT Early II Plant

In this, four genotypes *viz*., Co 12026, Co 12027, CoLk 12203 and CoPant 12221were evaluated with two standards CoJ 64 and Co 0238. The cane yield varied from 75.61 t/ha (Co 12029) to 86.98 t/ha (CoLk 12203) while the values were statistically non-significant (Table 7). Among the test clones, **Co 12027** recorded the highest sucrose in juice (18.1%) and CCS (10.04t/ha) being on par to the best check Co 0238 (17.68% and 10.36 t/ha, sucrose content and CCS, respectively).

AVT Early Ratoon

All the genotypes tested in plant crop were evaluated against the same checks for their performance in ratoon crop. The data contained in Table 7 revealed that **Co12027** recorded the highest sucrose % in juice (18.38) which was 0.74 units higher than the best check Co 0238 which recorded 17.64 % sucrose in juice. The cane yield (62.2 t/ha) recorded for this clone was lower (71.49 t/ha) as compared to the obtained under the best performing check (Co 0238).

IVT Midlate

In mid-late group, thirteen test clones with four standards were evaluated for cane yield and quality traits in IVT trial. Among the test clones, eight genotypes namely CoLk 14203, CoLk 14205, CoPb 14183, CoPb 14184, CoPb 14185, CoS 14231 CoS 14232 and CoS 14233 were found to be higher yielders than all the checks. CoS 14232 (92.38 t/ha) recorded the highest cane yield with CCS 11.78 t/ha, however, as compared with the best check (Co 05011), these values were not significant (Table 8). Overall, three clones namely **CoS 14232** (11.78 t/ha), **CoS 14231** ((11.38 t/ha) and **CoLk 14203** (11.28 t/ha) exhibited comparable CCS (t/ha) against the best performing check Co 05011 (10.88 t/ha).

AVT Midlate Plant I

This trial consisted of five test clones and four standards evaluated for cane yield and quality traits (Table 8). All the test entries were either superior or at par for cane yield with high scoring check CoPant 9722 (82.73 t/ha). The clones **CoPant 13224** and **CoH 13263** both recorded significantly higher cane yield (>94t/ha) than the best check. CoH 13263 recorded the highest sucrose (18.67% in juice) and CCS (12.1 t/ha).

AVT Midlate Plant II

In advance varietal trial of mid-late II plant, nine clones including six test and three standards were assessed for cane yield and quality parameters. The test clones **CoPant 12226** (105.99 t/ha) and **Co 12029** (102.42 t/ha) recorded significantly higher cane yields than the best check CoPant 97222 (85.7 t/ha). As regards to sucrose content in juice, CoS 12232 (18.37%) and Co 12029 (18.2%) were high scorer/ comparable to the best performing check CoPant 97222 (18 %). CoPant 12226 recorded the highest CCS (13.62 t/ha) followed by Co 12029 (13.11 t/ha) which were found to be on par with superior check (11.07 t/ha) (Table 9).

AVT Midlate ratoon

Advance varietal trial of mid-late ratoon conducted with six test clones along with three standards showed that cane yield among test clones ranged from 61.43 t/ha to 90.08 t/ha. The highest cane yield was recorded by CoPant 12226 (90.08 t/ha) followed by Co 12029 (89.38 t/ha). The highest sucrose % in juice (17.56) and CCS (11.01 & 10.23 t/ha) were also recorded by these two test clones. Overall, these two test clones exhibited more consistent yield and quality traits (Table 9).

Table 6: Performance of genotypes under IVT (Early) and AVT (Early) I Plant, (NWZ), Mean of 9 centres

Genotype	IVT (Early)			Genotype	AVT (Early) I Plant		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
Co 14034	95.19	17.31	11.50	Co 13034	88.80	18.48	11.37
CoLk 14201	93.41	15.80	10.14	CoPb 13181	89.77	17.52	10.86
CoLk 14202	89.33	15.90	9.72	CoS 13231	77.84	18.27	9.84
CoPant 14222	76.50	16.45	8.65	-	-	-	-
CoPb 14181	91.84	17.27	10.92	-	-	-	-
CoPb 14182	83.78	16.34	9.33	-	-	-	-
CoPb 14211	92.21	17.03	10.86	-	-	-	-
Standards							
CoJ 64	76.85	17.22	9.17	CoJ 64	77.19	17.77	9.51
Co 0238	88.99	17.62	10.88	Co 0238	88.15	18.14	11.12
Co 05009	80.54	16.91	9.47	Co 05009	77.14	17.23	9.32
CV(%)	10.84	3.95	13.30	CV(%)	12.50	3.28	13.41
SE(d)	4.709	0.331	0.669	SE(d)	4.899	0.277	0.654
LSD at 5%	9.4093	0.6617	1.3377	LSD at 5%	9.9017	0.56	1.3209

Table 7: Performance of genotypes under AVT (Early) II Plant and Ratoon (NWZ), Mean of 9 centres

Genotype	AVT (Early) II Plant			Genotype	AVT (Early Ratoon)		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
Co 12026	75.61	17.62	9.16	Co 12026	67.53	17.80	8.58
Co 12027	79.70	18.10	10.04	Co 12027	62.20	18.38	8.13
CoLk 12203	86.98	16.37	9.64	CoLk 12203	69.63	15.77	7.70
CoPant 12221	85.83	16.43	9.49	CoPant 12221	74.65	16.27	8.52
Standard							
CoJ 64	74.69	17.60	8.94	CoJ 64	59.19	17.80	7.48
Co 0238	85.50	17.68	10.36	Co 0238	71.49	17.64	8.83
CV(%)	12.20	3.47	12.75	CV(%)	12.80	4.91	14.02
SE(d)	4.965	0.300	0.612	SE(d)	4.616	0.454	0.615
LSD at 5%	NS	0.6097	NS	LSD at 5%	9.4279	0.9263	NS

Table 8: Performance of genotypes under IVT (Midlate) and AVT (Midlate) I Plant, (NWZ), Mean of 9 centres

Genotype	IVT (Midlate)			Genotype	AVT (Midlate) I Plant		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
Co 14035	80.36	17.92	9.95	Co 13035	87.84	18.20	11.02
CoH 14261	82.89	18.55	10.63	CoH 13263	94.01	18.67	12.10
CoH 14262	77.77	17.74	9.53	CoPant 13224	94.43	18.06	11.83
CoLk 14203	92.21	17.84	11.28	CoPb 13182	86.08	18.09	10.65
CoLk 14204	82.43	18.53	10.52	CoLk 13204	85.92	17.87	10.58
CoLk 14205	86.11	18.02	10.84	-	-	-	-
CoPb 14183	90.54	17.61	10.86	-	-	-	-
CoPb 14184	90.98	17.48	10.97	-	-	-	-
CoPb 14185	90.96	17.85	11.26	-	-	-	-
CoPb 14212	84.93	17.90	10.53	-	-	-	-
CoS 14231	90.80	18.05	11.38	-	-	-	-
CoS 14232	96.73	17.53	11.78	-	-	-	-
CoS 14233	92.38	17.66	11.25	-	-	-	-
Standard							
CoS 767	81.81	17.58	9.93	CoS 767	77.17	17.83	9.44
CoS 8436	77.09	18.06	9.58	CoS 8436	71.89	18.64	9.21
CoPant 97222	86.08	17.93	10.73	CoPant 97222	82.68	18.42	10.51
Co 05011	85.99	18.07	10.88	Co 05001	80.55	18.19	10.07
CV(%)	12.36	3.97	13.48	CV(%)	11.60	2.38	12.53
SE(d)	5.71	0.38	0.77	SE(d)	4.90	0.217	0.66
LSD at 5%	11.34	NS	NS	LSD at 5%	9.89	0.43	1.33

Table 9: Performance of genotypes under AVT (Midlate) II Plant and AVT (Ratoon) (NWZ), Mean of 9 centres

Genotype	AVT (Midlate) II Plant			Genotype	AVT (Midlate) Ratoon		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
Co 12029	102.43	18.20	13.11	Co 12029	89.38	17.56	11.01
CoH 12263	86.99	17.50	11.19	CoH 12263	61.43	16.76	7.06
CoLk 12205	87.42	17.44	11.18	CoLk 12205	77.18	16.56	8.74
CoPant 12226	105.99	17.91	13.62	CoPant 12226	90.08	16.89	10.59
CoPb 12211	79.62	17.46	10.53	CoPb 12211	74.91	15.94	8.14
CoS 12232	95.12	18.37	12.20	CoS 12232	83.81	17.57	10.23
Standard							
CoS 767	79.24	17.76	10.57	CoS 767	75.97	16.75	8.83
CoS 8436	74.96	18.39	10.34	CoS 8436	58.85	17.36	7.06
CoPant 97222	85.70	18.00	11.07	CoPant 97222	73.65	17.06	8.76
CV(%)	13.34	3.20	10.97	CV(%)	21.49	4.33	22.48
SE(d)	5.57	0.27	0.60	SE(d)	8.180	0.37	1.00
LSD at 5%	11.13	0.54	1.19	LSD at 5%	16.39	0.73	2.01

East coast zone

The East coast zone comprises Anakapalle, Cuddalore, Nayagarh, Nellikuppam and Vuyyuru centres located in the coastal region of Odisha, A.P and Tamil Nadu states of the country. All the centers were assigned eight experimental trials under during 2017-18. Salient research achievements are being summarised as under-

IVT Early

The IVT of the early group included four test clones *viz.*, CoC 15336, CoC 15337, CoC 15338, CoV 15356 along with three standards - CoA 92081, CoC 01061 and CoOr 03151. Among test genotypes, the cane yield varied from 97.68 t/ha (CoC 15337) to 117.32 (CoV 15356). The highest cane yield (117.32), sucrose % in juice (18.94) and CCS (15.78 t/ha) was obtained with CoV 15356. However, these values were on par to the best performing standard (CoOr 0315), recording cane yield and CCS to the tune of 113.4t/ha and 12.45 t/ha, respectively (Table 10). Overall, **CoV 15356** exhibited more promising cane yield and quality parameters.

AVT Early I Plant

In this**,** three genotypes namely Co 13023, CoA 14321 and CoC 14336 were assessed against three standards *viz*. CoA 92081, CoC 01061 & CoOr 0315. The clone **CoA 14321** recorded the highest cane yield (120.41 t/ha), with sucrose 18.37% in juice and CCS (15.64 t/ha). This clone showed consistent higher cane yield and sucrose content at four centers of the zone. Another clone **CoC 14336** also showed promising performance recording cane yield (110.29 t/ha), sucrose in juice (18.51%) and CCS (14.53 t/ha) over the checks (Table 10).

AVT Early Plant II

The AVT early for plant II included five test clones and two standards (Table 11). All the test clones recorded higher cane yield than both the checks. Among five genotypes, CoC 13337 recorded the highest cane yield (111.76 t/ha) followed by CoC 13336 (108.54 t/ha). Significantly higher sucrose % in juice (18.74) was observed in case of CoV 13356 than the best scorer check CoC 01061 (17.8). Overall, **CoC 13336** and **CoV 13356** recorded higher CCS (13.62 and 13.29t/ha respectively), being comparable to the checks (CCS 11.66 t/ha of both the checks).

AVT Early Ratoon

All the test clones along with standards tested in plant II were assessed for their performance in ratoon. A cumulative data showed that **CoV 13356** recorded the highest sucrose % in juice (17.89) and CCS 12.28 t/ha. **CoC 13336** also recorded cane yield and other quality characters like sucrose % in juice (17.76) and CCS 12.11 t/ha which was comparable to the checks which performed almost in similar fashion (Table 11).

IVT Mid late

Five clones *viz.*, CoC 15339, CoC 15340, CoOr 15346, PI 15376 and PI 15377 along with three standards - CoV 92102, Co 86249 and Co 06030 were assessed for cane yield and juice quality parameters under IVT midlate. Clone **CoC 15339** recorded significantly higher cane yield (123.35 t/ha) than the best check CoV 92102 (114.57 t/ha). All the test clones recorded sucrose % on par to the best check and the values ranged between 18.06 (CoC 15340) to 19.14 % in juice (PI 15376). However, none of the test clones performed better for quality traits than the best check (Table 12).

AVT Mid late I Plant

Six test clones *viz.*, Co 13028, , Co 13029, Co 13031 CoA 14323, COC 14337 and PI 14377 along with three standards *viz* CoV 92102, Co 86249 and Co 06030 were assessed for cane yield and juice quality parameters. Clone **CoA 14323** recorded the highest cane yield (124.56 t/ha),

sucrose % in juice 18.51 and CCS 16.37 t/ha followed by clone **PI 14377** recording cane yield 119.11 t/ha, sucrose % in juice 18.49 and CCS 15.59 t/ha (Table 12).

AVT Mid late II Plant

Four test clones *viz.*, Co 11326, Co 12324, CoC 13339 and CoOr 13357 along with two standards as CoV 92102 and Co 86249 were assessed. Clone **CoC 13339** recorded the highest cane yield (114.506 t/ha), sucrose % in juice 18.45 and CCS 14.86 t/ha followed by clone **CoA 12324** cane yield 102.5 t/ha, sucrose % in juice 18.29 and CCS 13.21 t/ha (Table 13). However, the data recorded for cane yield (101.93 t/ha) and CCS (13.15 t/ha) was on par to the best performing check (CoV 92102).

AVT Mid late Ratoon

All the test clones along with the same check varieties were assessed under AVT ratoon by all the five centers of the zone. The clone **CoC 13339** recorded the highest cane yield (116.44 t/ha), sucrose % in juice (18.17) and CCS (14.92 t/ha). This clone recorded higher sucrose content (0.31 unit) and about 24 t/ha more cane yield than the best performing check (CoV 92102) which recorded 17.86 % sucrose in juice and 92.2 t/ha cane yield (Table 13).

Table 10: Performance of genotypes under IVT (Early) and AVT (Early) I Plant, (ECZ)

Genotype	IVT (Early)			Genotype	AVT (Early) I Plant		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
CoC 15 336	103.04	17.67	11.83	Co 13 023	102.81	17.86	12.94
CoC 15 337	97.68	16.71	11.43	CoA 14 321	120.41	18.37	15.64
CoC 15 338	88.92	17.68	10.40	CoC 14 336	110.29	18.51	14.53
CoV 15 356	117.32	18.94	15.78				
Standards							
CoA 92081	102.22	17.87	12.96	CoA 92081	101.86	18.04	13.11
CoC 01061	107.69	17.55	13.34	CoC 01061	104.66	17.79	13.17
CoOr 03151	113.40	16.71	12.45	CoOr 0311	107.90	17.26	13.22
CV(%)	21.06	5.53	27.82	CV(%)	11.91	3.26	13.13
SE(d)	13.90	0.61	2.22	SE(d)	8.14	0.37	1.14
LSD at 5%	NS	1.27	NS	LSD at 5%	NS	0.77	NS

Table 11: Performance of genotypes under AVT (Early) II Plant and AVT (Early) Ratoon (ECZ)

Genotype	AVT (Early) II Plant			Genotype	AVT (Early) Ratoon		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
CoA 13 322	107.34	17.2	12.95	CoA 13 322	101.20	16.55	11.75
CoA 13 323	99.59	17.68	12.36	CoA 13 323	85.86	17.66	10.60
CoC 13 336	108.54	17.99	13.62	CoC 13 336	95.83	17.76	12.11
CoC 13 337	111.76	16.59	13.02	CoC 13 337	98.15	17.26	12.06
CoV 13 356	99.98	18.74	13.29	CoV 13 356	97.25	17.89	12.28
Standard							
CoC 01061	93.07	17.80	11.65	CoA 92081	89.41	17.75	11.28
CoA 92081	95.78	17.39	11.66	CoC 01061	92.86	17.75	11.66
CV(%)	7.44	4.61	9.99	CV(%)	12.48	4.78	13.64
SE(d)	4.81	0.51	0.80	SE(d)	8.33	0.59	1.13
LSD at 5%	9.93	1.06	NS	LSD at 5%	NS	NS	NS

Table 12: Performance of genotypes under IVT (Midlate) and AVT (Midlate) I Plant, (ECZ)

Genotype	IVT (Midlate)			Genotype	AVT (Midlate) I Plant		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
CoC 15339	123.35	18.40	16.05	Co 13028	103.32	17.64	12.75
CoC 15340	107.40	18.06	11.75	Co 13029	115.67	17.02	13.87
CoOr 15346	116.53	18.19	14.92	Co 13031	112.14	18.49	14.58
PI 15 376	112.81	19.14	15.33	CoA 14323	124.56	18.51	16.37
PI 15 377	109.69	18.70	14.47	CoC 14337	115.89	18.39	15.10
-	-	-	-	PI 14377	119.11	18.49	15.69
Standard							
CoV 92102	114.57	19.01	15.51	CoV 92102	109.39	18.27	14.21
Co 86249	97.85	18.04	12.61	Co 86249	106.78	17.45	13.02
Co 06 030	110.05	19.03	14.70	Co 06 030	105.23	17.62	14.21
CV(%)	12.02	3.94	16.56	CV(%)	10.72	4.54	12.14
SE(d)	8.48	0.46	1.54	SE(d)	7.63	0.52	1.11
LSD at 5%	NS	NS	NS	LSD at 5%	NS	1.05	2.25

Table 13: Performance of genotypes under AVT (Midlate) II Plant and AVT (Midlate) Ratoon (ECZ)

Genotype	AVT (Midlate) II Plant			Genotype	AVT (Midlate) Ratoon		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
CoA 11326	96.79	18.07	12.32	CoA 11326	103.04	17.67	11.83
CoA 12324	102.50	18.29	13.21	CoA 12324	97.68	16.71	11.43
CoC 13339	114.06	18.45	14.86	CoC 13339	88.92	17.68	10.40
CoOr 13357	103.41	17.22	12.47	CoOr 13357	117.32	18.94	15.78
Standard							
CoV 92102	101.93	18.26	13.15	CoV 92102	92.2	17.86	11.52
Co 86249	92.96	16.81	10.87	Co 86249	92.60	16.93	13.34
CV(%)	10.51	5.45	13.85	CV(%)	21.06	5.53	27.82
SE(d)	6.77	0.61	1.12	SE(d)	13.90	0.61	2.22
LSD at 5%	NS	NS	NS	LSD at 5%	NS	1.27	NS

Peninsular zone

In view of developing high yielding and high sucrose varieties, following experiments were conducted at 18 centres of the zone situated at Akola, Basmathnagar, Coimbatore, Kolhapur, Mandya, Navasri, Padegaon, Perumalapalle, Powarkheda, Pravaranagar, Pune, Pugalur, Kawardha (Raipur), Rudrur, Sameerwadi, Sankeshwar, Sirugamani, Thiruvalla. The climate of this zone is mainly tropical in nature where long sunny days with cool nights and clear sky favour sugar accumulation. The crushing season is also long. The results are summarized here under-

IVT Early

In this 37 test clones along with 3 standards were assessed for important yield and quality parameters (Table 14). Among test genotypes, the highest cane yield (134.17 t/ha) was observed under CoN 14071 followed by MS 14082 (cane yield 130.86 t/ha). However, the data were on par to the best performing standard (C0 86032, cane yield 129.97 t/ha). For sucrose percentage in juice standard CoC 671 was observed to be the best (20.87) while among test clones, **PI 14131** (21.26%) recorded the highest sucrose in juice with comparable cane yield (102.66 t/ha). Overall, MS 14032 test clone recorded marginally higher CCS (18.2 t/ha) t/ha) over the best check Co 86032 ((18.07 t/ha).

AVT Early Plant I

Total eight test genotypes against three standards *viz* Co 86032, CoC 671 and CoSnk were assessed for cane yield and quality parameters. For cane yield, VSI 12121 (120.13 t/ha), Co 12012 (116.83 t/ha) and Co 12009 (112.25 t/ha) performed better than the best check CoC 671 (101.55 t/ha). **VSI 12121** recorded the highest cane yield (120.13 t/ha) and CCS (16.7t/ha) with comparable sucrose % in juice (19.27). In this trial CoC 671 performed better for sucrose (20.49%) than other checks (Table 15).

AVT Early Plant II

In advance varietal trial of early II plant, five test clones and three standards were assessed for cane yield and quality parameters. Clone CoM 11082 registered significantly higher cane yield (103.27 t/ha) and CCS (13.16 t/ha) than the best check CoC 671 (91.98 t/ha and 11.58 t/ha, cane yield and CCS), respectively with comparable sucrose% in juice (17.99). **Co11004** recorded the highest sucrose % in juice (18.19) while cane yield (95.42 t/ha) and CCS (12.37 t/ha) was on par with the best performing check (Table 15).

AVT Early Ratoon

All the genotypes evaluated for their second plant crop were also evaluated for their performance of ratoon crop. The pooled data on cane yield, sucrose content and CCS indicated that **CoM 11082** with higher sucrose percent (18.31) in juice and cane yield (90.04 t/ha) recorded the highest CCS (11.61 t/ha) over the best check (Co 85004) which recorded cane yield, sucrose percent and CCS in the tune of 84.49 t/ha, 17.89 % and 10.45 t/ha, respectively (Table 15). However, at different locations, one or the other genotypes performed better with regards to cane yield/sucrose.

AVT Midlate II Plant

Eight test clones along with two standards were assessed under advanced varietal trial II plant. Among the test genotypes, **CoM 11085** recorded the highest sucrose content (19.57%) in juice, cane yield (112.57 t/ha) and CCS 15.62 t/ha. **CoM 11086** recorded the highest cane yield (113.68 t/ha) with sucrose percent (18.94 in juice), comparable to both of checks.

AVT Midlate ratoon

All the entries tested in midlate trial for II plant crop were assessed for ratoon crop during 2017-18. Genotype, **Co 11012** recorded the highest cane yield (97.42 t/ha) and sucrose (18.62 %) in juice being on par to the best check Co 86032 (88.66 t/ha).

Table 14 : Performance of genotypes under IVT (Early) Peninsular Zone

Genotype	IVT (Early)			Genotype	IVT (Early)		
	Cane Yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane Yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
Co 14002	114.11	19.99	16.67	Co 14030	116.47	20.26	17.00
Co 14003	118.67	18.71	16.23	Co 14031	116.12	19.85	16.38
Co 14004	114.84	20.12	16.77	Co 14032	99.54	20.66	14.77
Co 14006	109.40	18.20	14.27	CoN 14073	116.41	18.75	15.28
CoN 14071	134.17	18.20	17.05	CoN 14074	120.55	18.16	15.34
CoN 14072	128.00	18.56	16.75	CoSnk 14103	108.46	18.68	14.56
CoSnk 14101	115.18	18.59	15.34	CoTl 14111	127.07	19.21	17.28
CoSnk 14102	123.30	18.81	16.70	CoTl 14112	120.07	18.61	15.96
CoT 14366	127.06	19.71	17.88	CoVC 14061	120.20	19.39	16.63
CoT 14367	113.22	18.77	15.28	CoVC 14062	127.88	19.57	17.68
MS 14081	116.93	19.55	16.47	PI 14131	102.66	21.26	15.83
MS 14082	130.86	19.37	18.20	PI 14132	94.16	20.84	14.07
Co 13021	119.97	19.07	16.25	VSI 14121	113.16	19.70	15.98
Co 13022	100.91	19.92	14.68	VSI 14122	115.14	18.51	14.87
Co 14008	115.36	19.40	16.12	**Standard**			
Co 14009	118.16	19.44	16.37	Co 86032	129.97	19.43	18.07
Co 14012	112.18	20.55	16.72	CoC 671	117.95	20.87	17.42
Co 14016	125.00	19.53	17.35	CoSnk 05103	116.53	18.69	15.68
Co 14022	118.21	18.93	16.04	CV(%)	14.98	5.44	15.23
Co 14023	127.11	18.58	16.70	SE(d)	8.765	0.526	1.232
Co 14025	115.18	19.42	16.03	LSD at 5%	17.255	1.0355	NS
Co 14026	113.81	18.69	15.44	-	-	-	-
Co 14027	108.10	19.50	15.10	-	-	-	-

Table 15: Performance of genotypes under AVT (Early) I Plant, (Peninsular Zone)

Genotype	AVT (Early) -I Plant			Genotype	AVT (Early) I Plant		
	Cane Yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane Yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
Co 12007	101.73	19.83	14.36	**Standard**			
Co 12008	95.80	20.12	13.71	Co 86032	108.32	18.97	14.63
Co 12009	112.25	19.45	15.80	CoC 671	101.55	20.49	14.90
Co 12012	116.83	17.90	14.84	CoSnk 05103	102.37	17.89	13.31
Co 12019	92.59	19.03	12.75	CV(%)	13.85	4.35	14.48
Co 12024	97.39	18.45	12.88	SE(d)	5.964	0.340	0.858
CoM 12085	111.25	19.65	15.79	LSD at 5%	11.819	0.6746	1.7012
VSI 12121	120.13	19.27	16.70	-	-	-	-

North Central and North-Eastern Zone

Total seven experiments in two categories – **IVT** (Early and mid-late) and **AVT** (Early- Plant I, Plant II and Ratoon; Mid-late –Plant II and Ratoon) were implemented by all the six centers *viz.* Bethuadahari, Buralikson, Gorakhpur, Seorahi, Motipur and Pusa. The better performing genotypes were compared with the best checks/standards in each group for cane yield, sucrose % juice & CCS (t/ha) etc.

IVT Early

In IVT early group, eight genotypes were evaluated against three standards *viz.* CoLk 94184, CoSe 95422 and CoSe 01421. The data on cane yield and sucrose % in juice at 10 month crop stage revealed that CoSe 14453 recorded the highest cane yield (88.83 t/ha) while sucrose % in juice (16.25) was 1.38 unit less than the best check CoLk 94184 (17.63). None of the entries could excel to the checks for sucrose % in juice and CCS yields (Table 16).

AVT Early Plant I

In this, three genotypes *viz* CoP 13437, CoSe 13451 and CoSe 13452 were evaluated and compared against CoLk 94184, CoSe 95422 and CoSe 01421. The genotype **CoSe 13451** recorded the highest cane yield (75.84 t/ha) and

CCS (9.1 t/ha) with comparable sucrose % in juice (17.16) as compared to the best performing check (CoLk 94184) having cane yield 74.26 t/ha, sucrose in juice 17% and CCS 8.3 t/ha). However, statistically the data were found to be non-significant (Table 16). The highest sucrose % (17.49) in juice was observed in **CoSe 13452** followed by **CoP 13437** (17.23%).

AVT Early Plant II

Three test entries *viz* CoLk 12207, CoP 12436 and CoSe 12451 were evaluated with two standards - BO 130 and CoSe 95422. The mean values of the data on sucrose % in juice and cane yield revealed that overall **CoLk 12207** recorded the highest cane yield (78 t/ha) and sucrose % in juice (16.97) with CCS 9.22 t/ha. However, the results were non-significant (Table 17).

AVT Early Ratoon

All the genotypes tested in AVT early plant II were also evaluated for their performance in ratoon crop. All the three entries recorded higher cane yields ranging from 65.48 t/ha to 66.46 t/ha while the best performing check (Bo 130) recorded 59.18 t/ha cane yield. As regards to sucrose % in juice, none of the test entries could excel to the best check (Bo 130, 17.18) and recorded the same in the range of 16.23 to 16.41% S in juice (Table 17).

IVT Mid-late

Twelve genotypes along with three standards *viz.* Bo 91, CoP 9301 and CoP 06436 were evaluated under IVT for their cane yields and quality attributes. Among the genotypes, CoP 14439 (89.64 t/ha), CoLk 14209 (86.03 t/ha), CoSe 14455 (82.72 t/ha) and CoP 14438 (80.38 t/ha) recorded higher cane yields than the best performing check CoP 9301 (75 t/ha). However the data were statistically non-significant. These entries recorded sucrose% in juice ranging between 17.1% to 17.67% against the highest value (17.83) recorded with high scorer check (CoP 9301, Table 18). The highest CCS (10.65 t/ha) was observed by **CoP 14439** followed by **CoSe 14455** (10.27 t/ha) and **CoLk 14209** (10.19 t/ha).

AVT Mid-late Plant II

Four entries *viz* CoLk 09204, CoLk 12209, CoP 12438 and CoSe 12453 were evaluated with two standards BO 91 and CoP 9301. Genotype, **CoLk 12209** recorded the highest sucrose (17.48 %) in juice, cane yield (79.59 t/ha) and CCS (9.8 t/ha). The best performing check CoP 9301 was observed with 74.93 t/ha cane yield, 17.86% sucose in juice and CCS as 9.19 t/ha (Table 18).

AVT Mid-late Ratoon

All the entries evaluated in AVT mid-late II were screened for their performance in ratoon crop. The highest cane yield (67.29 t/ha) was recorded by CoLk 09204 while among test entries the highest sucrose in juice (17.57%) was observed with CoLk 12209 (Table 19). The best performing check (CoP 9301) yielded 63.81 t/ha cane and recorded the highest sucrose % in juice (17.76). Overall **CoSe 12453** appeared to be a promising clone by recording higher cane yield with comparable sucrose content and CCS t/ha as compared with the higher scorer check.

Table 16: Performance of genotypes under IVT (Early) and AVT (Early) I Plant, (North Central & Eastern Zones)

Genotype	IVT (Early)			Genotype	AVT (Early) I Plant		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
CoBln 14501	64.11	16.03	7.32	CoP 13437	68.59	17.23	8.24
CoLk 14206	78.65	17.14	9.39	CoSe 13451	75.84	17.16	9.10
CoLk 14207	82.64	16.55	9.63	CoSe 13452	73.27	17.49	8.91
CoP 14436	76.79	17.39	8.89	-	-	-	-
CoP 14437	81.52	17.41	9.94	-	-	-	-
CoSe 14451	85.37	16.27	9.75	-	-	-	-
CoSe 14453	88.83	16.25	10.08	-	-	-	-
CoSe 14454	83.59	17.05	10.04	-	-	-	-
Standards							
CoLk 94184	83.46	17.63	10.40	CoLk 94184	74.26	17.00	8.73
CoSe 95422	79.53	16.91	9.38	CoSe 95422	73.81	16.49	8.50
CoSe 01421	84.16	16.63	9.10	CoSe 01421	65.63	15.02	7.77
CV(%)	15.21	5.46	16.81	CV(%)	15.89	11.71	16.93
SE(d)	7.771	0.582	1.004	SE(d)	8.078	1.385	1.022
LSD at 5%	NS	NS	NS	LSD at 5%	NS	NS	NS

Table 17: Performance of genotypes under AVT (Early) II Plant and Ratoon (North Central & Eastern Zones)

Genotype	AVT (Early) II Plant			Genotype	AVT (Early Ratoon)		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
CoLk 12207	78.00	16.97	9.22	CoLk 12207	66.46	16.31	7.46
CoP 12436	69.95	16.53	7.93	CoP 12436	65.48	16.41	7.30
CoSe 12451	74.19	16.84	8.65	CoSe 12451	66.23	16.23	7.42
Standards							
BO 130	68.17	16.74	7.97	BO 130	59.18	17.18	7.02
CoSe 95422	67.93	16.45	7.80	CoSe 95422	59.15	16.81	6.89
CV(%)	14.35	3.44	16.06	CV(%)	9.03	2.50	10.35
SE(d)	6.504	0.364	0.844	SE(d)	3.617	0.262	0.472
LSD at 5%	NS	NS	NS	LSD at 5%	NS	0.5555	NS

Table 18: Performance of genotypes under IVT (Midlate) and AVT (Midlate) II Plant, (North Central & Eastern Zones)

Genotype	IVT (Midlate)			Genotype	AVT (Midlate) II Plant		
	Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)		Cane yield (t/ha)	Sucrose (%) in juice	CCS (t/ha)
CoBln 14502	59.54	15.56	6.55	CoLk 09204	75.74	17.44	9.14
CoLk 14208	73.39	17.62	8.94	CoLk 12209	79.59	17.88	9.80
CoLk 14209	86.03	17.10	10.19	CoP 12438	76.43	17.35	9.04
CoLk 14210	81.39	16.43	9.18	CoSe 12453	73.67	17.39	9.00
CoP 14438	80.38	17.67	9.89	-	-	-	-
CoP 14439	89.64	17.28	10.65	-	-	-	-
CoSe 14452	82.32	16.91	10.02	-	-	-	-
CoSe 14455	82.72	17.55	10.27	-	-	-	-
CoSe 14456	75.69	17.28	9.37	-	-	-	-
Standards							
BO 91	69.75	17.06	8.20	BO 91	69.42	17.64	8.29
CoP 9301	75.00	17.83	8.92	CoP 9301	74.93	17.86	9.19
CoP 06436	77.28	17.53	9.66	CV(%)	11.76	2.74	12.23
CV(%)	19.22	4.90	19.42	SE(d)	5.573	0.305	0.702
SE(d)	10.570	0.594	1.280	LSD at 5%	NS	NS	NS
LSD at 5%	NS	1.2091	NS	-	-	-	-

Table 19 : Performance of genotypes under AVT (Midlate) Ratoon (North Central & Eastern Zones)

Genotype	AVT (Midlate) Ratoon		
	Cane yield (t/ha)	Sucrose % juice	CCS (t/ha)
CoLk 09204	67.29	16.95	7.98
CoLk 12209	63.13	17.57	7.56
CoP 12438	66.80	16.53	7.75
CoSe 12453	66.68	17.46	7.99
Standards			
BO 91	60.64	17.49	7.36
CoP 9301	63.81	17.76	7.93
CV(%)	12.01	3.51	12.55
SE(d)	4.915	0.383	0.616
LSD at 5%	NS	0.7999	NS

B. III Evaluation and identification of climate resilient ISH and IGH genetic stocks

(i) Evaluation under drought condition

The programme was implemented at four centers *viz.*, Padegaon, Anakapalle, Faridkot and Karnal. Twenty seven clones with three standards were evaluated under drought condition by withdrawing irrigation between 60 and 150 days after planting. The observations on various growth, yield and quality attributes were recorded and compared with the best check assigned for the respective centre. It

was observed that sucrose % in juice, cane fibre %, juice extraction % was less affected due to drought.

At Anakapalle, twenty seven clones along with three standards were assessed for plant crop under normal and drought conditions. The data showed differences among the clones for all the characters. In normal condition, the test clone AS 04-245 showed higher NMC of 115.74 thousands/ha followed by SA 04-496 (99.54 thousands/ha) and AS 04-1687 (97.69 thousands/ha) while the clone CYM 07-986 showed higher cane yield of 110.24 t/ha followed by AS 04-635 (109.12 t/ha), AS 04-245 (106.48 t/ha). However, under drought condition the clone MA 5/99 showed higher NMC of 110.19 thousands/ha followed by GU 07-3774 (101.39 thousands/ha) while the clone BM 1010168 showed higher cane yield of 67.37 t/ha. Among the entries, the clone BM 1003143 showed higher juice sucrose of 19.20 and 18.05 under normal and drought conditions which was on par with standard clone CoA 92081 (19.36 and 18.22) in both the conditions.

At the same center, fourteen clones alongwith three standards were evaluated in ratoon crop, the clone SA04-496 showed on par performance in normal (cane yield of 60.25 t/ha and sucrose percent in juice 17.21) and drought (cane yield of 85.81 t/ha and sucrose in juice 16.41%) when compared to superior standard clone CoA92081(87A298) in normal (cane yield of 83.95 t/ha and sucrose in juice 18.28%) as well as drought (cane yield of 70.10 t/ha and sucrose in juice 18.23%) conditions. The clone SA04-496 showed on par performance in normal as well as in drought conditions when compared to superior standard clone CoA92081 for NMC/ha, cane yield/ha and juice sucrose per cent.

At Karnal center, 27 test entries and three standards were evaluated for various cane yield, juice quality and morpho-physiological parameters. In general there was reduction in the expression of metric traits under drought compare to normal conditions. At harvest under drought there was reduction of 31.25%, 29.25%, 24.58%, 6.57%, 1.39%,11.99%, 7.19%, 0.97% and 1.60% compare to normal conditions for cane yield, CCS yield, NMC, cane height, cane dia, single cane weight, extraction%, brix and pol% respectively. Genotypes AS04-1689 (166.56 t/ha), AS04-2097 (141.81 t/ha), GU07-3849 (132.89 t/ha) and SA04-472 (116.25 t/ha) were top performer under normal conditions for cane yield among them genotypes AS 04-2097(109.85 t/ha) and AS04-1689 (103.5 t/ha) were best performer under drought conditions as well. Clone GU07-3774 depicted higher cane yield under drought (98.87 t/ha) compare to normal conditions (95.84 t/ha). Highest reduction in cane yield under drought conditions was observed in clones PG9869-137 (255%), followed by CoJ 88 (98.28%), MA5/37 (89.46%), MA 05/99 (87.0%), BM1022-173 (76.82%) and MA05/22 (73.71%) whereas the least reduction in cane yield was observed in genotypes GU07-3774 (-3.05%), BM 1005-149 (6.69%), SA04-458 (16.16%), SA04-496 (17.24%), AS04-1687 (22.45%) and CYM 07-986 (25.02%). Co 0238 with juice sucrose% of 19.36 under normal and 19.22 under drought was the best performer entry.

The ratoon trial depicted very high reduction in the expression of metric and juice quality traits. Highest reduction was observed for cane yield(64.09%) followed by tiller population at 90 days (53.08%), 120 days (48.15%), 180 days (44.75%), 150 days (44.45%), NMC (43.41%), juice extraction (31.96%) and single cane weight (19.13%). There was 6.3% gain in average juice brix under drought but juice sucrose was 4.5% lesser under drought compare to normal conditions.

(ii) Evaluation for water logging

The programme was assigned to four centers *viz*,. Kolhapur, Vuyyuru, Motipur and Pusa. At Kolhapur center, twenty seven test clones with three standards were evaluated. Among the tested clones, CYM 07-986, BM 1003143 and AS 04-1687 recorded higher cane yield and sucrose percent in juice. However, sucrose content in juice was less affected.

At SRS Vuyyuru center under waterlogged conditions, the clone BM 1009163 in recorded higher per cent juice sucrose at tenth month in second plant crop. Whereas, at twelfth month, the standard Co V 09-356 recorded higher sucrose in juice (20.60%) in first plant and (21%) in and second Plant crops, respectively. The standard Co V 09-356 also recorded higher per cent of juice sucrose (21.93) at 270 DAR and (20.76) at 330 DAR in ratoon crop during 2017-18.

Under normal conditions, in First plant crop (2016-17), in Second plant crop (2017-18), the clone SA 04-496 recorded higher per cent juice sucrose (20.2) at tenth month and (19.7%) at twelfth month. In Ratoon crop (2017-18), the standard Co V 09-356 recorded higher per cent juice sucrose (0.86) at 330 DAR. While under waterlogged conditions, in second plant crop (2017-18), the clone AS 14-1689 recorded higher cane yield (136.57 t/ha) whereas the standard Co V 09-356 recorded 125.00 t/ha cane yield. The standard Co V 09-356 recorded higher cane yield (120.37 t/ha) in ratoon crop (2017-18). Under normal conditions, in second plant crop (2017-18), the clone SA 04-454 recorded higher cane yield (120.37 t/ha) whereas the standard Co V 09-356 recorded 114.81 t/ha cane yield. In Ratoon crop (2017-18), the clone BM 1022173 recorded higher cane yield of 100.93 t/ha whereas the standard Co V 09-356 recorded 99.07 t/ha cane yield.

Sugarcane varieties identified

During meeting of Variety Identification Committee, held at the ICAR-IISR, Lucknow on 22nd November, 2017, three sugarcane varieties viz., CoLk 11206 (Ikshu-4), CoLk 11203 (Ikshu-5) and CoA 11321 were identified for release & notified in 2018 by CVRC.

(i) CoLk 11206 (Ikshu-4) : CoLk 11206 (Ikshu-4), a mid-late variety, selected from the progeny of the bi-parental cross (CoPant 90223 x Co 62198) and subsequently evaluated in clonal generations. Moderately resistant & resistant to red rot and smut and less susceptible to major insect- pests, midlate maturing variety. At 12 months stage, sucrose content in juice (17.65%), sugarcane yield level (91.50 t/ha), CCS level (11.20 t/ha) and pol content in cane (13.42%). This variety developed by ICAR-IISR, Lucknow under North West Zone.

(ii) CoLk 11203 (Ikshu-5): CoLk 11203 (Ikshu-5), a early variety, selected from the progeny of the bi-parental cross (CoLk 8102 x Co 1148) and subsequently evaluated in clonal generations. Resistant to red rot and smut and less susceptible to main insect- pests, early maturing variety. At 10 months stage, sucrose content in juice (18.41%), sugarcane yield level (81.97 t/ha), CCS level (10.52 t/ha) and pol content in cane (13.44%). This variety developed by ICAR-IISR, Lucknow under North West Zone.

(iii) CoA 11321: The variety CoA 11321 was developed from 80R 41GC. It is a thick yellowish green cane with black encrustation, cylindrical internodes with straight alignment. Medium size bud, round in shape, bud cushion and bud groove absent. Medium leaf length and leaf width, green in colour with open tip drooping. Resistant to red rot, susceptible to smut & wilt, less susceptible to early shoot borer, scale insect and High suscpeitble to inter nodal borer. At 10 months stage, sucrose content in juice (17.16%), sugarcane yield level (111.31 t/ha), CCS level (13.59 t/ha) and pol content in cane (13.73%). This variety developed by RARS, Anakapalle under East Coast Zone.

Summary

- Total twenty nine (Early 14, Midlate 13 and 2 trials combining early and midlate maturity groups) varietal trials were conducted during the year 2017-18.
- A total of 47 entries in early group, 58 in midlate groupand 45 entries combining early and midlate maturity groups were evaluated. Based on pooled analyses of the data on cane yield and quality attributing characters 13 in early and 17 in midlate group were found to be promising.
- In East Coast zone CoC 13339 (Midlate) and in North West zone CoS 12232 (Midlate) were identified as the qualifying entries based on the mean performance in two plant and one ratoon crops.
- National Hybridisation Garden (NHG) was planted with 607 parental clones during 2017-18. Flowering was delayed by more than 15 days and out of 607 parents, only 263 flowered. Per cent of clones flowered during 2017 was 43.33 % against 52.46 % during 2016 and 58.26 % during 2015.
- Twenty one centres participated in the crossing programme. Total 508 bi-parental test crosses, 2 selfs, 8 poly crosses and 211 GCs were effected. Fluff weighing 17.26 kg of crosses made at NHG and NDHF was supplied to the 23 participating centers.
- The programme "Evaluation and identification of climate resilient ISH and IGH genetic" was implemented for both drought (Padegaon, Anakapalle, Faridkot and Karnal) and water logging (Kolhapur, Vuyyuru, Motipur and Pusa) conditions.
- Twenty seven clones with three standards were evaluated under drought condition. The observations revealed that sucrose % in juice, cane fibre %, juice extraction % was less affected due to drought.
- At SRS Vuyyuru center under waterlogged conditions, the clone BM 1009163 in second plant crop recorded higher sucrose per cent juice(20.03) at tenth month stage. Among the test clones, CYM 07-986, BM 1003143 and AS 04-1687 recorded higher cane yield and sucrose percent in juice at Kolhapur. However, sucrose content in juice was less affected.
- At Karnal center, there was reduction in the expression of traits under drought as compared to normal conditions. At harvest there was reduction of 31.25%, 29.25%, 24.58%, 6.57%, 1.39%,11.99%, 7.19%, 0.97% and 1.60% compared to normal conditions for cane yield, CCS yield, NMC, cane height, cane dia, single cane weight, extraction%, brix and pol%, respectively.

2. CROP PRODUCTION

In India sugarcane cultivation is facing continual challenges like escalating cost of cultivation, plateaueding productivity of the crop, scarcity of labour, depleting soil fertility and productivity in major sugarcane producing regions. Climate change induced weather aberrations mainly rainfall deficit with erratic distribution along with rising minimum temperature have rendered farming of this crop further challenging. Such a scenario has severely dented the profitability of sugar mills which in turn has resulted in their tapered interest for sugarcane development work in their factory command areas. Farmers on the other hand are not getting timely remuneration for the crop and hence often are not in a position to arrange inputs in time. The silver linings of palpable yield and recovery improvement in sub-tropics, however are enough to boost our morale and continue rigorous testing of applicable technologies.

In order to provide user-friendly technology to the growers the Crop Production discipline encompassing Agronomy and Soil Science continues to play important role in devising and testing of such location specific technologies for sugarcane cultivation. During the crop season 2017-18, five trials (experiments) were conducted on various aspects such as agronomic evaluation of promising genotypes for their performance potential under variable inter-row spacing and enhanced fertility level, integrated nutrient management schedule for sugarcane production system to ensure soil health and crop productivity, carbon sequestration potential of sugarcane based cropping systems impacting soil health, raising water productivity in sugarcane system through mulching and water application regimes and also to assess the effect of plant growth regulators on germination, growth and cane and sugar productivity. Most of the centres carried out these trials and reported the results in the prescribed format. However, Akola faced the constraints like scarcity of irrigation water and could not conduct the trials. A summary table of stipulated experiments conducted during 2017-18 is given in *Appendix I.*

The experiment wise summary of the results is presented below:

AS 68: Impact of integrated application of organics and inorganics in improving soil health and sugarcane productivity

The trial was initiated during the year 20104-15 at all the centres, while during the year 2017-18, only 19 centres carried out the trial.

NORTH WEST ZONE

1. FARIDKOT

Plant cane yield (101.4 t/ha) was the highest with application of FYM @ 20 t/ha + inorganic nutrient based on soil test (T6) which was significantly higher over all other treatments except T5.

2. LUCKNOW

The highest number of tillers (176.9 thousand /ha at 120 days after planting), shoot count (165.3 thousand/ha at 180 DAP), number of millable canes (124.8 thousand/ha), plant cane yield (89.20 t/ha) and sugar yield (10.69 t/ha) were recorded under the treatment where application of FYM @ 20t/ha was done along with soil test (rating chart) based inorganic fertilizer recommendations.

3. PANTNAGAR

The highest cane yield in ratoon was recorded in the treatment T6 - application of FYM @ 20 tonnes/ha + inorganic nutrient application based on soil test (NPK application). The highest cane yield (T6) could be higher NMC, cane girth, cane length and weight of individual cane. CCS yield was recorded highest in T5, which was significantly higher over rest of the treatments.

4. UCHANI

Application of FYM 20 t/ ha + 100% RDF through inorganic source (T6) and FYM @ 10 t/ ha + biofertilizer (Azotobacter/ Acetobacter + PSB) + soil test basis (T9) were found best and at par treatments in terms of number of tillers (146.4, 144.3 thousands/ha) , millable canes (116.5, 117.2 thousands/ha) and cane yield (101.3, 99.8 t/ha) and sugar yield (12.79, 12.27 t/ha), respectively, as compared to rest of the treatments.

5. KAPURTHALA

Soil test based fertilizer application (190 kg N ha-1) along with 20 t ha-1 FYM produced highest plant cane yield that was statistically similar to treatment T3, T5 and T9 but it was significantly higher over the cane yield produced under remaining treatments. Cane yield produced under treatments T2, T4 and T7 were also similar but significantly higher than the cane yield under treatment T1.

6. SHAHJAHANPUR

Application of FYM @ 10 tonnes/ ha + bio – fertilizers (Azotobacter + PSB) + application of nutrients on soil test basis (NPK) produced significantly higher cane yield (114.10 t/ha) than that of other treatments. CCS% in cane was found to be almost similar.

7. SRIGANGANAGAR

Cane yield (80.3 t/ha) was the highest with the application of FYM @ 20 tones/ha + inorganic nutrient based on soil test (T6), which was significantly higher over other treatments except T5 – application of FYM @ 20 q/ha + 100% RDF (77.9 t/ha), T9 - Application of FYM/Compost @ 10 t/ ha + biofertilizer (*Azotobacter/ Acetobacter* + PSB) + soil test basis NPK application (77.1 t/ha) and T8 - Application of FYM/Compost @ 10 t/ ha + biofertilizer (*Azotobacter/Acetobacter* + PSB) + 100% RDF (75.2 t/ ha).

PENINSULAR ZONE

1. THIRUVALLA

In both the ratoon crops (I & II) among the various treatments, T8 (FYM/compost @ 10 t/ha + biofertilizer (*Azotobacter/Acetobacter* + PSB) +100 RDF) recorded significantly higher cane length (265 and 255 cm, respectively), MNC (73240 and 71320/ha) and yield (81.10 and 74.48 t/ha).

2. MANDYA

The data indicated that application of FYM @ 20 t/ha + inorganic nutrient application based on soil test results recorded significantly higher cane yield (156.93 t/ha) compared to all other treatments. However, it was on par with application of FYM @ 20 t/ ha + 100% RDF (141.30 t/ha), application of FYM @ 10 t/ ha + biofertilizer (Azotobacter + PSB) + 100% RDF (146.27 t/ha) and application of FYM @ 10 t/ha + biofertilizer (Azotobacter + PSB) + soil test basis fertilizer application (149.80 t/ha).

3. SANKESHWAR

Soil test based nutrients application along with 20 t/ha farm yard manure recorded the highest cane yield (119.83 t/ha), number of millable canes (97500/ha) and CCS yield (11.36 t/ha). However, treatments with soil test based nutrients application recorded on par cane yield irrespective of application of organics and microbial inoculants. The lowest cane yield (92.43 t/ha) was recorded in 50 percent inorganics without any organics application.

4. PADEGAON

Sugarcane (CoM 0265) was planted on 02.202.2017 and harvested on 07.03.2018. Higher cane yield (176.94 t/ ha), CCS yield (21.15 t/ha) and number of millable cane (83093) were observed in treatment T6 receiving RDF as per soil test along with 20 t/ha FYM and it was found at par with treatment T9, T5 and T8. The brix, sucrose (%), CCS (%) and purity (%) were found to be non-significant.

5. NAVSARI

The first ratoon crop was initiated on 12.12.2016 and harvested on 18.12.2017. Ratoon cane yield (120.15 t/ ha) was recorded significantly highest with T9 over T3 and remained at par with T4, T5, T6 and T7. CCS yield was not significantly influenced due to various nutrient management treatments. Various quality parameters were not significantly influenced due to different nutrient management treatments at 10 and 12 months.

6. COIMBATORE

In second ratoon sugarcane crop, 20 t FYM + 150 STCR based fertilizer application was found beneficial in improving cane yield over rest of the nutrient management treatments. The treatment 20 t FYM + 150 STCR based fertilizer application recorded the highest NMC (95150 NMC/ha) and cane yield (84.56 t/ha). Sugarcane juice analysis done at 12 months revealed that Sucrose %, Purity % and CCS % were not influenced significantly by application of organics and in organics.

7. PUNE

The results concluded that application of FYM /compost @ 10 t/ha with inorganic fertilizer based on soil test and biofertilizer or application of FYM /compost @ 20 t/ha with inorganic fertilizer based on soil test increased cane yield by 13.4 t/ha.

EAST COAST ZONE

1. CUDDALORE

Application of FYM/Compost @ 10 tones/ha + biofertilizers (*Acetobacter* + PSB) + soil test based NPK fertilizer recorded significantly the maximum cane yield (157.69 t/ha), CCS (12.35 %) and sugar yield (19.47) with B:C ratio of 3.37 and it was comparable with treatment (T8) application of FYM/Compost @ 10 tonnes ha-1 + biofertilizer (*Azotobacter* + PSB) + 100 % RDF.

2. ANAKAPALLE

The results indicated that application of FYM @ 10 t/ha + biofertilizer + 100% inorganic nutrient (87.6 t/ha) or application of FYM @ 10 t/ha+ biofertilizer+ inorganic nutrient application based on soil test (86.9 t/ha) registered significantly higher cane yield as compared to the other treatments. Application of trash at 10 tonnes /ha + 50% RDF registered lowest cane yield of 69.7 t/ha.

3. NAYAGARH

Results obtained from plant crop indicated that application of FYM/Compost @ 10t/ha + Azotobacter + PSB with 100% RDF (T8) and application of FYM/Compost @ 10t/ ha + Azotobacter + PSB + Soil test based (NPK) fertilizer application (T9) recorded higher percentage of germination at 45 DAP i.e. 55.56 and 60.59%, respectively. The NMC and Cane yield were 86660 & 93.04 t/ha in T8 and 91500 & 98.35 t/ha in T9, respectively. This exhibits the positive effect of organic manures and bio fertilizers on cane yield

NORTH CENTRAL ZONE

1. SEORAHI

Application of FYM @ 10 t/ha+ Bio-fertilizer (*Azotobacter* + PSB) + soil test basis (NPK Application) gave significantly higher cane yield at par with FYM @ 10 t/ ha+ Bio-fertilizer (*Azotobacter* + PSB) +100 per cent RDF and FYM @ 20 t/ha + Inorganic nutrient application based on soil test. Sucrose percent was not affected significantly by different treatments.

2. PUSA

Integrated application of nutrients was found effective in improving soil fertility and cane yield. The application of fertilizers on soil test i.e. 200 kg N, 100 kg P2O5 and 100 kg K2O along with organics @ 20 t/ha was found suitable for boosting cane yield and maintaining soil fertility in calcareous soil of Bihar.

SALIENT FINDINGS

Results of 19 AICRP (S) centres allocated in five different zones revealed that application of FYM /Compost @ 20 tonnes/ha + inorganic nutrient application based on soil test (rating chart) recorded the highest cane yields and CCS yields in North West zone and Peninsular zone while application of FYM/Compost @ 10 tonnes / ha + biofertilizer + soil test basis recorded the highest single cane weight, cane yield and CCS yield in remaining two zones (North Central and East coast zones). The highest number of millable cane noticed in all zones except east cost zone through application of FYM /Compost @ 20 tonnes/ha + inorganic nutrient application based on soil test (rating chart). Similar pattern was also recorded for sigle cane weight across the zone but both the nutritional treatments (T6&T9) were found at par to each other and significantly superior over majority of treatments especially trash application (Table 1.1 to1.4).

Table 1.1/AS 68: Effect of integrated application of organics and inorganics on NMC (000/ha).

Treatment	North West Zone (5)	Peninsular Zone (7)	North Central Zone (1)	East Coast Zone (3)
T1: Trash @ 10 tonnes/ha + 50% RDF	76.24	77.11	94.12	81.10
T2: Trash @ 10 tonnes/ha + 100% RDF	87.93	85.81	106.65	96.93
T3: Trash @ 10 tonnes/ha + soil test based recommendation	90.71	86.38	115.97	100.72
T4: FYM/Compost @ 20tonnes/ha +50% RDF (inorganic source)	82.21	82.77	104.30	86.60
T5: FYM/Compost @ 20 tonnes / ha +100% RDF (inorganic source).	98.24	87.80	112.84	104.20
T6: FYM/Compost @ 20 tonnes / ha + inorganic nutrient based on STRC	104.76	91.78	127.07	105.74
T7: FYM/Compost @ 10 tonnes / ha + biofertilizer + 50% RDF.	85.42	84.34	110.44	92.84
T8: FYM/Compost @ 10 tonnes / ha + biofertilizer + 100% RDF.	100.90	89.84	120.10	105.09
T9: FYM/Compost @ 10 tonnes / ha + biofertilizer + soil test basis.	104.14	90.68	126.23	110.30
CV(%)	8.42	5.82	8.12	10.69
SE(d)	4.91	2.69	9.180	8.571
LSD at 5%	10.01	5.40	NS	NS

Table 1.2 AS 68: Effect of integrated application of organics and inorganics on individual cane weight (g).

Treatment	North West Zone (4)	Peninsular Zone (6)	North Central Zone (1)	East Coast Zone (2)
T1: Trash @ 10 tonnes/ha + 50% RDF	678.75	1435.00	722.00	981.50
T2: Trash @ 10 tonnes/ha + 100% RDF	806.25	1525.00	755.00	1298.50
T3: Trash @ 10 tonnes/ha + soil test based recommendation	837.00	1573.33	778.00	1470.00
T4: FYM/Compost @ 20tonnes/ha +50% RDF (inorganic source)	755.50	1536.67	739.00	1158.50
T5: FYM/Compost @ 20 tonnes / ha +100% RDF (inorganic source).	893.75	1656.67	750.00	1406.50
T6: FYM/Compost @ 20 tonnes / ha + inorganic nutrient based on STRC	955.50	1706.67	783.00	1488.50
T7: FYM/Compost @ 10 tonnes / ha + biofertilizer + 50% RDF.	795.00	1515.00	700.00	1240.00
T8: FYM/Compost @ 10 tonnes / ha + biofertilizer + 100% RDF.	856.00	1710.00	750.00	1580.00
T9: FYM/Compost @ 10 tonnes / ha + biofertilizer + soil test basis.	929.00	1703.33	801.00	1648.50
CV (%)	11.05	7.27	6.65	11.03
SE(d)	65.192	67.019	29.00	150.347
LSD at 5%	134.55	135.45	NS	346.7

Table 1.3/AS 68: Effect of integrated application of organics and inorganics on cane yield (t/ha).

Treatment	North West Zone (7)	Peninsular Zone (7)	North Central Zone (2)	East Coast Zone (3)
T1: Trash @ 10 tonnes/ha + 50% RDF	61.24	96.84	55.80	76.83
T2: Trash @ 10 tonnes/ha + 100% RDF	75.07	110.58	67.70	90.33
T3: Trash @ 10 tonnes/ha + soil test based recommendation	78.79	114.66	76.50	95.37
T4: FYM/Compost @ 20tonnes/ha +50% RDF (inorganic source)	70.06	111.58	59.80	87.67
T5: FYM/Compost @ 20 tonnes / ha +100% RDF (inorganic source)	84.61	125.52	76.75	101.40
T6: FYM/Compost @ 20 tonnes / ha + inorganic nutrient based on STRC	89.06	132.98	89.65	107.13
T7: FYM/Compost @ 10 tonnes / ha + biofertilizer + 50% RDF.	69.19	113.44	67.00	92.67
T8: FYM/Compost @ 10 tonnes / ha + biofertilizer + 100% RDF.	71.37	127.87	84.00	107.57
T9: FYM/Compost @ 10 tonnes / ha + biofertilizer + soil test basis.	88.83	131.45	91.60	112.87
CV(%)	16.79	7.98	10.53	11.15
SE(d)	6.86	5.05	7.824	8.822
LSD at 5%	13.80	10.15	18.04	18.701

Table 1.4/AS 68: Effect of integrated application of organics and inorganics on CCS yield (t/ha).

Treatment	North West Zone (5)	Peninsular Zone (7)	North Central Zone (1)	East Coast Zone (2)
T1: Trash @ 10 tonnes/ha + 50% RDF	7.23	12.06	6.01	9.90
T2: Trash @ 10 tonnes/ha + 100% RDF	9.33	13.84	8.44	12.63
T3: Trash @ 10 tonnes/ha + soil test based recommendation	9.71	14.37	9.75	13.07
T4: FYM/Compost @ 20tonnes/ha +50% RDF (inorganic source)	8.79	13.74	6.88	11.82
T5: FYM/Compost @ 20 tonnes / ha +100% RDF (inorganic source).	10.97	16.01	8.47	14.51
T6: FYM/Compost @ 20 tonnes / ha + inorganic nutrient based on STRC	11.70	16.83	10.19	15.45
T7: FYM/Compost @ 10 tonnes / ha + biofertilizer + 50% RDF.	8.64	13.79	6.47	13.14
T8: FYM/Compost @ 10 tonnes / ha + biofertilizer + 100% RDF.	8.92	15.76	8.53	15.68
T9: FYM/Compost @ 10 tonnes / ha + biofertilizer + soil test basis.	11.41	16.45	10.48	15.84
CV (%)	19.60	10.70		12.72
SE(d)	1.194	0.845		1.72
LSD at 5%	2.4324	1.6983	2.3	NS

IMPORTANT OBSERVATIONS

Following salient points emerged from findings:

- Application of nutrients from organic and inorganic sources was found consistently better over the use of fertilizers alone, across the centres located in zones.
- Application of organics amendments like FYM or compost recorded significant improvement in cane and sugar yield over that with trash mulching under the use of recommended dose of fertilizers across the locations. Use of organic sources brought about substantial enhancement in soil health parameters.

AS 69: Use of plant growth regulators (PGRs) for enhanced yield and quality of sugarcane

The trial was initiated during 2015-16 with an objective of assessing the response of sugarcane crop to plant growth regulators for improving in germination, growth and yield. The trial was allocated to all the centres and only 21 centres conducted the trial. Centre wise summary is given below.

NORTH WEST ZONE

1. FARIDKOT

Germination of sugarcane was better with treating the seed cane by 50 &100 ppm Ethrel solution than no treatment. Ethrel helped in advancing the germination process helping in higher germination at early stage. The highest cane yield (94.7 t/ha) was observed in T8 (planting of setts after overnight soaking in 100 ppm Ethrel solution and GA_3 (35 ppm) spray at 90, 120 and 150 DAP).

2. KOTA

Based on three years data, combination of PGR, planting of setts after overnight soaking in 100 ppm ethrel solution + GA_3 spray at 90,120,150 DAP was found effective for increasing plant growth characters *viz.*, plant height, tillers, leaf area, root dry weight, number of millable

cane, cane weight, cane yield and quality parameters i.e. Brix, Sucrose (%), CCS (%) CCS yield, purity (%), GR and NR which was significantly superior over T1 and T2 treatments and at par with rest of treatments .followed by T 7- Planting of setts after overnight soaking in 50 ppm ethrel solution + GA_3 (35 ppm) spray at 90, 120 and 150 DAP treatment also same trend.

3. KAPURTHALA

Overnight setts soaking in water and pre-soaked cane with 100 ppm Ethrel solution followed by GA_3 (35 ppm) spray at 90, 120 and 150 DAP produced cane of statistically similar cane weight but it was significantly higher over the of rest of treatments. Cane yield under treatment T8 was significantly higher than the cane yield under all other treatment.

4. LUCKNOW

The findings revealed significantly higher cane bud germination due to overnight ethrel soaked setts treatment than conventional and water soaked treatment however 50 and 100 ppm overnight ethrel solution soaked treatments germination per cent was statistically at par. The higher cane yield (98.90 t/ha) was recorded in the planting of setts after overnight soaking in 100 ppm ethrel solution and three GA3 spray (35 ppm) at 90, 120 and 150 days after planting.

5. PANTNAGAR

Germination%, higher shoot population, higher NMC, higher cane weight, length of the cane were recorded in the treatment T4 and T8 of ethrel soaking of setts @ 100 ppm which was triggered by GA3 application 35 ppm applied at 90, 120 and 150 DAP. Higher cane yield in T6 was the result of heavier cane (individual cane), higher NMC, cane length and cane girth. Initial plant population however was lower than T7 and T5 but due to better fertility status of the soil shoot population was higher at 120, 150 and 180 DAR. CCS yield and sucrose % were also higher in T6 followed by T5 and found at par. Juice cane yield, CCS yield and sucrose % at harvest were higher in T5 and T6 so available sugar % at harvest was highest in T6 followed by T5.

6. SHAHJAHANPUR

Germination % recorded under overnight soaking in 100 ppm ethrel solution was at par with overnight soaking in 50 ppm ethrel solution and it was significantly superior to conventional and overnight soaking in water. Planting of setts after overnight soaking in 100 ppm etheral solution + Gibberellic acid (35 ppm) resulted significantly higher cane yield (90.00t/ha) than those of other treatments.

7. UCHANI

Dipping of setts in 50 ppm and 100 ppm ethrel being at par recorded significantly higher germination at 20, 30, 40 and 50 DAP as compared to control and water soaked treatments. Soaking of setts in 50 ppm ethrel+ GA_3 spray (T7) and 100 ppm ethrel+GA_3 (T8) being at par recorded significantly higher number of tillers, NMC, cane yield and sugar yield as compared to soaking of setts in ethrel at 50 and 100 ppm ethrel alone, conventional practices with and without GA_3 and water soaking treatments with and without GA3 spray at 90, 120 and 150 Days after planting.

8. SRIGANGANAGAR

The highest cane yield (99.7 t/ha) was recorded in T8 (planting of setts after overnight soaking in 100 ppm ethrel solution + GA_3 (35 ppm) spray at 90, 120 and 150 DAP which was significantly better than T1, T2 and T5 but at par with T7 - T3 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP (98.8 t/ha), T4 - Planting of setts after overnight soaking in 100 ppm ethrel solution (95.7 t/ha), T6 - T2+ GA_3 spray (35 ppm) at 90, 120 and 150 DAP (94.6 t/ha) and T3 - Planting of setts after overnight soaking in 50 ppm ethrel solution (94.4 t/ha).

PENINSULAR ZONE

1. PADEGAON

The germination was found significantly higher with planting of setts after overnight soaking in 50 ppm ethrel solution followed with GA_3 spray (T7) and it was found at par with treatments T3, T5, T6 and T8 at 40 DAP and with T4 and T6 at 50 DAP. The planting of setts after overnight soaking in 50 ppm ethrel solution with GA_3 spray (35 ppm) at 90, 120 and 150 DAP (T7) recorded significantly the highest cane yield while CCS yield was not affected significantly by different treatments. All quality parameters like, brix, sucrose (%), purity (%) and CCS (%) were not affected by different treatments.

2. NAVSARI

Significantly highest cane yield (121.48 t/ha) was noticed with treatment T8 (planting of setts after overnight soaking in 100 ppm ethrel solution + GA_3 (35 ppm) spray at 90, 120 and 150 DAP) but remained at par with T3, T4, and T7 over T1. CCS yield was recorded significantly highest with T4 and found at par with T3, T6, T7 and T8. Various quality parameters were not significantly influenced due to different treatments.

3. MANDYA

Overnight soaking of setts in 100 ppm ethrel solution followed by 35 ppm GA_3 spray at 90, 120 and 150 DAP found to enhance the germination percentage and cane

yield. However, at par yield to above treatments was also recorded in overnight soaking of setts in 100 ppm ethrel solution.

4. POWARKHEDA

The cane yield increased significantly due to planting of setts after overnight soaking in 50 ppm ethrel solution (126.95 t/ha) as compared to T2 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP (117.90 t/ha), planting of setts after overnight soaking in water (118.21 t/ha), T1 + GA_3 (35 ppm) spray at 90, 120 and 150 DAP (119.03 t/ha) and conventional planting/Farmers practice (3- bud setts) (119.24 t/ha).

5. PUNE

The pooled results of the three plant crops indicated that, maximum germination (62.94%) at 30 DAP, NMC (0.81 lakh/ha), cane girth (11.60 cm), cane yield (167.22 t/ha) and B:C ratio (1:3.17) was recorded when the setts were overnight soaked in 100 ppm Ethrel before planting and foliar spraying of Gibberellic acid 35ppm at 90,120 &150 DAP. The maximum tillering (1.34 lac/ha) at 120 DAP was found in overnight soaking of setts in 50 ppm Ethrel and spraying of GA_3 (35ppm).

6. THIRUVALLA

Maximum cane length (260.33 cm), MCC (83180/ ha), cane yield (111.23 t/ha) were recorded under T8. Sugar yield also showed same trend and recorded significantly higher value (11.60 t/ha) for the very same treatment (T8). There was some variation in the soil fertility parameters prior to and after the conduct of the trial (Table AS 69.13.1). The highest BC ratio of 1.40 was also recorded by T8.

7. SANKESHWAR

Overnight soaking of setts in water or 50 ppm ethrel solution followed by GA_3 sprays at 90, 120 and 150 days after planting and overnight soaking of setts in 100 ppm solution alone without any sprays to the crop further has enhanced the germination percent, cane yield and yield attributes without impairing the quality parameters.

8. KOLHAPUR

The conventional planting of 2-bud sugarcane setts with GA3 spray (35 ppm) at 90, 120 and 150 DAP) recorded numerically higher cane yield (100.83 t/ha) whereas, planting of 2-bud setts after overnight soaking in 50 ppm ethrel solution recorded numerically higher CCS yield (14.55 t/ha).

EAST COAST ZONE

1. ANAKAPALLE

During 2017-18 studies on use of plant growth regulators (PGRs) for enhanced yield and quality of sugarcane was studied at Regional Agricultural Research Station, Anakapalle and plant growth regulators influenced was not observed on growth as well as yield of sugarcane as the crop was affected due to yellow leaf disease. Pooled mean indicated that highest number of millable canes (69,728 / ha) and cane yield (75.3 t/ha) was noticed with planting of setts after overnight soaking in 100 ppm ethrel solution +GA3 Spray (35 ppm) at 90,120 and 150 DAP.

2. CUDDALORE

Among the treatments, the setts treated with ethrel 100 ppm with foliar spray of GA3 35 ppm on 90, 120 and 150 DAS was recorded significantly the maximum millable canes (175630/ha), cane yield (148.65 t/ha), CCS (12.78 %) and sugar yield (19.00 t/ha).

3. NAYAGARH

Planting of setts after soaking in 100 PPM ethrel solution along with GA3 spray at 90, 120 & 150 DAP proved to be the best with highest number of net millable canes (90.11 thousand/ha), cane yield (102.97 t/ha) and CCS yield (12.82.t/ha).

NORTH CENTRAL ZONE

1. PUSA

On the basis of economics, planting of setts after overnight soaking in 50 ppm ethrel solution was found optimum as it has resulted in statistically comparable yield (96.3 t/ha) and B : C ratio (1.26) over higher level of ethrel and GA3 application.

NORTH EASTERN ZONE

1. BURALIKSON

In case of cane yield planting of setts after overnight soaking in 100 ppm ethrel solution followed by spraying of GA3 spray (35ppm) at 90,120 and 150 DAP recorded the higher yield (71.1 t/ha) followed by planting of setts after overnight soaking in 50 ppm ethrel solution followed by spraying of GA3 spray (35ppm) at 90,120 and 150 DAP (68.5 t/ha). The same treatment also recorded also higher growth parameters than all other treatments.

SALIENT FINDINGS

Results of 21 AICRP (S) centres assigned for all the five different agro-climatic zones revealed that planting of setts after overnight soaking in 100 ppm ethrel solution enhanced the germination of sugarcane in all the zones except north central zone (Table 1.1). Planting of setts after overnight soaking in 100 ppm ethrel solution followed by spray of GA_3 @ 35 ppm at 90,120 and 150 DAP recorded the highest cane yield in all zones *viz.*, North West, East coast and North East zone except Peninsular and North Central zone (Planting of Setts after overnight soaking in 50 ppm ethrel solution) which was slightly at par to other previous zones but both were significantly superior over the convention planting/farmers practices (Table 1.4). The highest commercial cane sugar yield was recorded through planting of setts after overnight soaking in 100 ppm ethrel solution followed by spray of GA_3 @ 35 ppm at 90,120 and 150 DAP in all the zones.

Similar trend was also recorded in respect to number of millable cane and single cane wight yield in all of zones (Table1.2 &1.3). Hence, planting of setts after overnight soaking in either 50/100 ppm ethrel solution followed by spraying of GA_3 @ 35 ppm at 90,120 and 150 DAP proved effective at most of the zones in increasing sugarcane yield and quality.

Table 1.1/AS 69: Effect of plant growth regulators (PGRs) on % germination of sugarcane

Treatment	North West Zone (8)	Peninsular Zone (6)	North Central Zone (1)	North East Zone (1)	East Coast Zone (3)
T1: Conventional planting/farmers Practice (3 Bud Setts)	36.68	55.40	32.8	37.7	62.34
T2: Planting of Setts after overnight soaking in water.	40.36	55.60	41.1	44.5	66.82
T3: Planting of Setts after overnight soaking in 50 ppm ethrel solution.	45.47	60.45	56.1	50.0	70.74
T4: Planting of Setts after overnight soaking in 100 ppm ethrel solution	47.54	64.30	54.3	52.2	69.00
T1 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	38.05	57.16	34.2	37.4	65.51
T2 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	40.19	57.71	39.3	43.4	72.00
T3 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	46.49	63.22	**55.7**	49.3	69.26
T4 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	**48.36**	**65.73**	54.8	**51.7**	**72.61**
CV (%)	5.30	5.95	8.5	-	7.27
SE(d)	1.14	2.06	2.27	-	4.067
LSD at 5%	2.28	4.18	6.9	0.46	NS

Table 1.2/AS 69: Effect of plant growth regulators (PGRs) on NMC (000/ha) of sugarcane.

Treatment	North West Zone (8)	Peninsular Zone (7)	North Central Zone (1)	North East Zone (1)	East Coast Zone (3)
T1: Conventional planting/farmers Practice (3 Bud Setts)	100.33	74.65	117.1	58.6	92.75
T2: Planting of Setts after overnight soaking in water.	106.46	77.79	122.0	63.7	95.03
T3: Planting of Setts after overnight soaking in 50 ppm ethrel solution.	116.18	82.65	148.6	74.4	97.63
T4: Planting of Setts after overnight soaking in 100 ppm ethrel solution	117.97	84.20	146.2	74.4	98.86
T1 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	104.94	79.53	123.3	66.1	98.60
T2 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	108.78	80.46	126.2	74.3	100.07
T3 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	120.47	**85.74**	**153.1**	78.2	104.98
T4 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	**124.03**	85.13	150.5	**78.9**	**109.40**
CV (%)	4.79	7.30	9.0	-	7.50
SE(d)	2.691	3.173	7.09	-	6.106
LSD at 5%	5.40	6.404	21.5	3.62	NS

Table 1.3/AS 69: Effect of plant growth regulators (PGRs) on cane weight (g).

Treatment	North West Zone (7)	Peninsular Zone (7)	East Coast Zone (2)
T1: Conventional planting/farmers Practice (3 Bud Setts)	980.17	1352.86	1265.00
T2: Planting of Setts after overnight soaking in water.	1053.29	1395.71	1290.00
T3: Planting of Setts after overnight soaking in 50 ppm ethrel solution.	1113.04	1467.14	1420.00
T4: Planting of Setts after overnight soaking in 100 ppm ethrel solution	1122.81	1551.43	1520.00
T1 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	1019.79	1457.14	1475.00
T2 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	1057.59	1508.57	1480.00
T3 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	1141.64	1621.43	1565.00
T4 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	1199.16	1567.14	1640.00
CV (%)	6.79	8.00	3.62
SE(d)	39.434	63.76	52.70
LSD at 5%	79.58	128.67	124.62

Table 1.4/AS 69: Effect of plant growth regulators (PGRs) on yield (t/ha) of sugarcane.

Treatment	North West Zone (8)	Peninsular Zone (7)	North Central Zone (1)	North East Zone (1)	East Coast Zone (3)
T1: Conventional planting/farmers Practice (3 Bud Setts)	79.13	109.40	71.4	51.0	88.53
T2: Planting of Setts after overnight soaking in water.	84.17	110.26	78.9	56.4	88.23
T3: Planting of Setts after overnight soaking in 50 ppm ethrel solution.	92.11	120.44	96.3	60.1	91.20
T4: Planting of Setts after overnight soaking in 100 ppm ethrel solution	96.83	122.35	94.5	62.8	91.20
T1 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	85.84	115.75	77.6	52.6	91.74
T2 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	91.30	122.03	83.5	63.4	93.33
T3 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	99.81	128.24	101.8	68.5	95.62
T4 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	102.97	127.21	98.7	71.1	99.11
CV (%)	3.41	8.03	10.0	-	3.94
SE(d)	1.56	5.13	5.06	-	2.968
LSD at 5%	3.14	10.34	15.3	5.36	6.37

Table 1.5/AS 69: Effect of plant growth regulators (PGRs) on sugar /CCS yield (t/ha).

Treatment	North West Zone (6)	Peninsular Zone (7)	North East Zone (1)	East Coast Zone (3)
T1: Conventional planting/farmers Practice (3 Bud Setts)	9.94	14.25	6.3	10.34
T2: Planting of Setts after overnight soaking in water.	10.49	14.51	7.0	10.39
T3: Planting of Setts after overnight soaking in 50 ppm ethrel solution.	11.73	15.98	7.6	10.98
T4: Planting of Setts after overnight soaking in 100 ppm ethrel solution	12.57	16.21	7.8	11.11
T1 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	10.83	15.02	6.6	11.04
T2 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	11.48	16.02	8.1	10.89
T3 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	12.59	16.69	8.7	11.47
T4 + GA_3 spray (35 ppm) at 90, 120 and 150 DAP	13.16	16.78	9.1	11.86
CV (%)	4.16	7.19	-	5.83
SE(d)	0.28	0.602	-	0.524
LSD at 5%	0.57	1.22	0.80	NS

IMPORTANT OBSERVATIONS

- There was significant improvement in the rate and extent of germination of sugarcane due to overnight soaking of setts in ethrel solution.
- The effective concentration of ethrel solution for germination improvement was found to be 100 ppm in north western zone and east coast zone and 50 ppm in peninsular, north central, north eastern zones.
- Foliar spray of GA_3 during tillering phase could not improve the cane yield significantly over sett soaking in ethrel solution at most of the centres.

AS 70: Scheduling irrigation with mulch under different sugarcane planting methods

The trial was initiated during 2016-17 and was allocated to all the centres. In all, 18 centres carried out the trial as per common technical programme for the year. Centre wise summary of findings are given below.

NORTH WEST ZONE

1. FARIDKOT

Among the planting methods paired row trench planting with trash mulching recorded significantly higher cane yield (100.7 t/ha) than planting methods. Trash mulching resulted in significantly higher cane yield than all others irrespective of planting methods. Cane yield increased successively and significantly with increase in irrigation water application from 0.6 to 1.0 IW/CPE. Apparent water productivity (AWP) and total water productivity (TWP) were significantly higher in paired row trench planting than conventional planting.

2. KOTA

Based on the two year of study, it can be concluded that paired row trench planting (30:120 cm row spacing) with organic mulching sugarcane trash @ 6 t/ha was found better with respect to number of tillers, plant height, millable canes, cane yield, cane weight, brix (%) and water use efficiency, resulted in significantly higher net return over P1 and P2 planting methods. However, irrigation water at IW: CPE ratio of 0.80 was found economical in sugarcane yield when compared with 0.60 and 1.00 IW: CPE ratios and also noted significantly enhancement in economics with each successive increase in irrigation regimes from 0.60 to 0.80 IW: CPE ratio which was proportionally more than the increase in irrigation water i.e. IW: CPE ratio of 1.00.

3. KAPURTHALA

Paired row trench planting with mulch produced significantly higher cane yield than other planting methods (105.1 t/ha). Planting sugarcane in paired row without mulch (97.3 t/ha), in single row with mulch (95.6 t/ha) and without mulch (92.1 t/ha) produced statistically similar cane yield.Irrigations scheduling did not significantly influence the germination %, plant height at 150 DAP and cane diameter whereas other parameters were significantly influenced by irrigation scheduling. Irrigation application at IW/CPE ratio 1.0 produced significantly higher no of shoots and that were at par with irrigation application at IW/CPE ratio 0.8 but these were significantly better over irrigation application at IW/CPE ratio 0.6.

4. LUCKNOW

Sugarcane yield (114.3 t/ha) was significantly higher under paired-row trench planting with trash mulching than conventional flat method of planting along with trash mulching (101.9 t/ha) followed by paired-row trench planting with no mulching (98.3 t/ha) and conventional flat method of planting with no mulching (95.9 t/ha). The WUE was found maximum under paired-row trench planting with trash mulching (0.982 t/ha- cm) followed by conventional flat method of planting with trash mulching (0.877 t/ha-cm) and paired-row trench planting (0.845 t/ha-cm).

5. PANTNAGAR

On the basis of present study it was observed that significantly higher cane yield and NMC were recorded in paired row planting (30: 120) with mulch over flat and with or without mulch. However germination % at 45 DAP could not influenced due to method of sugarcane planting and use of mulch. Cane yield was highest in 1.0 IW/CPE ratio over 0.6 IW/CPE. Cane yield was statistically similar in 0.8 or 1.0 IW/CPE ratio.

6. SHAHJAHANPUR

Paired row trench planting (120:30 cm row spacing) with organic mulch@ 6 t/ha produced higher cane yield (79.17 t/ha) and maximum water use efficiency (1109.30 kg/ha cm) than those of other planting methods and mulch practices. Irrigation schedule at 1.00 IW/CPE ratio (I3) produced significantly higher cane yield (79.80t/ha) with minimum water use efficiency (1088.75) followed by 0.80 IW/CPE ratio (I2) with cane yield of 75.58 t/ha and water use efficiency (1228.25 kg/ha cm).

7. UCHANI

Significantly higher germination, tillers, NMC, cane weight and cane yield were recorded in paired row trench planting (30:120 cm) as compared to conventional planting at 75 cm row spacing. Trash mulching resulted in significantly higher cane yield as compared to without mulching treatments. Interaction between method of planting and irrigation levels was found non-significant. Total (Irrigation+ rainfall) water was calculated as 175.7,

190.7 and 205.7 cm in conventional and 153.7, 162.7 and 171.7 cm in paired row trench planting at 0.6, 0.8 and 1.0 IW/CPE irrigation schedule, respectively. Highest yield of cane produced/1000 litres of irrigation (12.18 kg) water was recorded in trench planting at 0.8 IW/CPE irrigation schedule

PENINSULAR ZONE

1. PADEGAON

Furrow planting (120 cm row spacing) with green manure (sunnhemp) sown at 30 DAP, mulched at 75 DAP followed by earthing-up at 110 DAP (P2) was found significantly superior for cane and CCS yields. While irrigation schedules not affects the Cane and CCS yields. The higher water use efficiency was recorded in Furrow planting (120 cm row spacing) with alternate skip furrow irrigation after earthing –up with green manure/brown mulching (P4) and irrigation schedule with 0.60 IW/CPE. (I1). All quality parameters were found to be non-significant.

2. POWARKHEDA

Results revealed that the cane yield was influenced significantly due to different planting methods. Furrow planting (120 cm row spacing) with green manure (cowpea) sowing at 30 DAP, mulching at 75 DAP and earthing -up at 110 DAP recorded higher cane yield of (104.82 t/ha) than Furrow planting (120 cm row spacing) with alternate skip furrow irrigation, after earthing- up without mulching (97.44). Significantly higher cane yield obtained at I3 1.00 (102.49 t/ha) as compared to cane yield recorded with I1 0.60 (97.23) but at par in I2 0.80 (100.35 t/ha).

3. MANDYA

Furrow planting (120 cm row spacing) with alternate skip furrow irrigation after earthing up + *dhaincha* green manure mulching found to enhance the water use efficiency and gave at par yield as that of 120 cm row spaced furrow planting with *dhaincha* green manure with full irrigation at IW/CPE ratio 1.0.

4. NAVSARI

Significantly highest cane (114.19 t/ha) and CCS (15.24 t/ha) yield was noticed with planting method P4 but cane yield remained at par with P2 over other methods and CCS yield at par with P1 and P2. Significantly highest cane (118.62 t/ha) and CCS (15.82 t/ha) yield was observed with irrigation level I3 over I1 and I2.

5. THIRUVALLA

The growth and yield attributes recorded in P4 (furrow planting at 120 cm spacing with alternate skip furrow irrigation after earthing up + green manure/brown mulching was significantly superior to other planting methods and mulch practices tried. The maximum cane length (262.56 cm), cane diameter (3.18 cm), single cane weight (1.56kg), MCC (82000/ha), cane yield (101.0 t/ha) and sugar yield (9.47 t/ha) were recorded by P4. With regard to irrigation schedule, the highest value for cane length (259.92 cm), cane diameter (3.10 cm), MCC (77020/ha), cane yield (81.55 t/ha) and sugar yield (7.99t/ha) were recorded by I3 (IW/CPE ratio 1.00).

EAST COAST ZONE

1. ANAKAPALLE

Studies on scheduling irrigation with mulch in sugarcane indicated that significantly higher cane yield (85.0 t/ha) was recorded in scheduling irrigations at frequent intervals at 1.0 IW/CPE (I3) as compared to scheduling irrigations at longer intervals at 0.6 IW/CPE (74.0 t/ha) and on par with scheduling irrigation at IW/CPE of 0.8 (79.5 t/ha) treatments. Furrow irrigation with mulching recorded significantly higher cane yield of 83.7 t/ha over all the other treatments. Interaction effect was found non-significant.

2. CUDDALORE

Among the methods of planting, the furrow planting of sugarcane setts at 120 cm spacing with green manure sowing at 30 DAP, mulch at 75 DAP and earthing up 120 DAP recorded significantly the maximum cane yield (142.56 t/ha), sugar yield (18.13 t/ha) and B:C ratio of 3.65 and adopting the IW/CPE ratio of 1.0 recorded significantly the maximum cane yield (136.14 t/ha), sugar yield (16.99 t/ha) and B:C ratio 3.64.

3. NAYAGARH

Furrow planting (120 cm row spacing) with alternate skip furrow irrigation after earthing-up + brown mulching method produced higher NMC and cane yield of 91442/ha and 100.59 t/ha respectively which was closely followed by furrow planting (120 cm row spacing) with brown mulching (NMC and cane yield 90699/ha and 100.06 t/ha). Irrigating the crop at IW/CPE ratio of 1.0 produced highest NMC and sugarcane yield of 92930/ha and 106.30 t/ha, respectively which is significantly different from irrigating the crop at IW/CPE ratio of 0.6 (NMC and cane yield 85.03'000/ha and 92.433 t/ha, respectively).

NORTH CENTRAL ZONE

1. PUSA

Paired row trench planting (30: 120 cm row spacing) with trash mulching @ 6 t/ha (P3) being at par with paired row trench planting (30: 120 cm row spacing) without trash mulching (P4) produced significantly higher millable canes (143300/ha) and cane yield (99.5 t/ha) over other planting methods. Among the levels of irrigation, irrigation scheduled at IW: CPE ratio 1.00 recorded the significantly

higher plant population (224500/ha), cane diameter (2.37 cm) and millable canes (125000/ha).

2. SEORAHI

Among planting methods, paired row trench planting (120:30 cm row spacing) with organic mulch @6t/ha (P3) treatment gave significantly higher germination per cent, shoot population, NMC and cane yield over conventional flat planting (75 cm row spacing) with organic mulch @6t/ha (P1) and conventional flat planting (75 cm row spacing) without mulch (P2) treatments but among the irrigation scheduling IW/CPE 1.0 ratio was found the best. Cane yield increased with increase in IW/CPE ratio. Sucrose per cent was not affected significantly with different treatments.

NORTH EASTERN ZONE

1. BURALIKSON

Data revealed that no significant difference was observed among the irrigation schedule on yield and quality of sugarcane. However, the highest cane yield was recorded by paired row trench planting (30:120 cm row spacing) with organic mulching @ 6 t/ha (88.92t/ha) which is statistically at par with paired row trench planting (30:120 cm row spacing without mulch (86.70t/ha) but superior over other two planting methods. Moreover, no significant differences were recorded in case of quality of sugarcane.

SALIENT FINDINGS

The highest cane yield was recorded by paired row trench planting (30:120 cm row spacing) with organic mulching sugarcane trash @ 6 t/ha in North West zone (95.05 t/ha), North central zone (97.56 t/ha) and North East zone (88.92 t/ha) of country (Table 1.1). The highest water productivity was also recorded by this treatment in North West zone. In Peninsular zone, Furrow planting (120 cm row spacing) with alternate skip furrow irrigation after earthing was recorded the highest cane yield (125.91 t/ha) which closely at par to Furrow planting (120 cm row spacing) with green manure (*dhaincha*) sowing at 30 DAP, mulching at 75 DAP and earthing. In contrast to peninsular zone Furrow planting (120 cm row spacing) with green manure (*dhaincha*) sowing at 30 DAP, mulching at 75 DAP and earthing in East coast zone recorded the significantly the highest cane yield (108.79 t/ha) over other method of planting. Irrigating scheduling at IW/CPE ratio of 1.0 produced the highest cane yield over other schedules in all the zones (Table 1.2). Paired row trench planting (30:120 cm row spacing) with mulching sugarcane trash @ 6 t/ha revealed the highest water use efficiency (**985.78** kg/ha.cm**)** in north western zone. The highest water productivity was recorded in east coast as comarea to other zone of country (Table 1.1& 1.2). However, the significantly highest water productivity was recorded through paired row trench planting (30:120 cm row spacing) with mulching sugarcane trash @ 6 t/ha in North West zone.

Table 1.1/AS 70: Effect of scheduling irrigation with mulch under different sugarcane planting methods on cane yield (t/ha) and water productivity (kg/ha.cm) of sugarcane.

Planting methods and mulching practices	North West Zone		North Central Zone	North East Zone
	Yield (t/ha)	Water productivity (kg/ha-cm)	Yield (t/ha)	Yield (t/ha)
Conventional flat planting (75 cm row spacing) with organic mulching sugarcane trash @ 6 t /ha	87.03	712.39	80.94	84.83
Conventional flat planting (75 cm row spacing) without mulch.	84.09	702.09	72.12	81.37
Paired row trench planting (30:120 cm row spacing) with mulching sugarcane trash @ 6 t/ha.	95.05	985.78	97.56	88.92
Paired row trench planting (30:120 cm row spacing) without mulch.	92.85	954.00	92.84	86.70
CV (%)	5.11	20.19	3.03	-
SE(d)	2.45	97.73	2.60	-
LSD at 5%	5.15	208.31	8.29	2.45
Irrigation schedule (IW/CPE)				
I_1: 0.60	82.58	973.73	76.57	85.00
I_2: 0.80	92.17	888.06	85.66	84.83
I_3: 1.0	94.57	818.79	95.37	85.70
CV (%)	5.03	14.10	5.18	-
SE(d)	2.41	72.75	4.448	-
LSD at 5%	5.26	NS	NS	NS

Table 1.2/AS 70: Effect of scheduling irrigation with mulch under different sugarcane planting methods on yield and water productivity.

Planting methods and mulching practices	Peninsular Zone		East Costal Zone	
	Yield (t/ha)	Water productivity (kg/ha-cm)	Yield (t/ha)	Water productivity (kg/ha-cm)
Furrow planting (120 cm row spacing) without mulching	114.04	575.40	102.85	1074.60
Furrow planting (120 cm row spacing) with green manure (*dhaincha*) sowing at 30 DAP, mulching at 75 DAP and earthing	125.88	647.55	108.79	1428.00
Furrow planting (120 cm row spacing) with alternate skip furrow irrigation after earthing	115.75	624.20	100.45	1367.60
Furrow planting (120 cm row spacing) with alternate skip furrow irrigation after earthing	125.91	737.55	105.16	1407.75
CV(%)	4.51	5.47	4.05	16.85
SE(d)	3.43	35.33	3.448	222.300
LSD at 5%	10.48	NS	NS	NS
Irrigation schedule (IW/CPE)				
I_1: 0.60	109.21	660.50	98.00	1296.68
I_2: 0 .80	118.36	667.45	104.60	1292.67
I_3: 1.0	126.02	627.90	109.13	1286.56
CV (%)	6.69	7.29	98.00	4.17
SE(d)	4.99	47.517	104.60	5.94
LSD at 5%	11.50	NS	109.13	NS

IMPORTANT OBSERVATIONS

The experiment was initiated during the year (2016-17) and was allotted to all the centres. However, only 18 centres carried out the trial as per the technical programme. Salient findings are enumerated below:

- Planting of sugarcane in paired rows (120: 30) with mulching of trash (6 t/ha) in the inter-row spaces out yielded the conventional flat method with or without mulch at all the centres in north western, north central and north eastern zones. Being in the climatic region of high evaporative demand sugarcane crop responded up to 1.0 IW/CPE irrigation regime in the zones. However similar yields have been recorded with 0.8 IW/CPE ratio at several centres. Trash mulching could effectively save 20-26% irrigation water over no-mulching.

- Sugarcane crop in peninsular and east-coast zones responded to furrow planting (120 cm) and skip furrow irrigation combined with the use of leguminous crop as green manure till 75 DAP, as a mulch during tillering and thereafter residue incorporation. As par irrigation regimes, IW/CPE ratio 1.0 resulted in higher cane productivity. However, it could be restricted to 0.8 for getting higher water use efficiency in these zones.

- Use of mulch in sub-tropical zone and green manuring followed by mulching and residue incorporation resulted in higher net return.

AS 71: Carbon sequestration assessment in sugarcane based cropping system

The trial was initiated during 2016-17 and allocated to all the centres. In all, 15 centres conducted the trial in accordance with the approved technical programme.

NORTH WEST ZONE

1. FARIDKOT

During 2017-18 wheat yield was significantly higher when sown after rice. The wheat following sugarcane was significantly better in T7 and T8 than T3 and T4. Sugarcane yield was better in T3, and T7 where trash was incorporated and was significantly higher than T4, T6 and T8 where trash was removed. Cane equivalent yield was also higher in T3, T5 and T7 than other treatments

2. KOTA

Based on the two year study of soil properties, it can be concluded that soybean-wheat-moongbean (residue retention with *Trichoderma*) treatment was found better with respect to significantly enhancement in OC, infiltration rate, bulk density, WHC and Nutrient status of soil over T3 and T4 treatments. Whereas in case of ratoon

T6 recorded significantly higher germination, tillers, plant height, cane diameter, cane weight, cane yield as well as juice quality parameters over rest of treatments.

3. KAPURTHALA

Cane equivalent yield was significantly higher in T3 that was at par with cane yield in treatments T5, T6 and T7 but it was significantly higher than the yield under remaining treatments.

4. LUCKNOW

Ratoon crop yielded 109.8 t/ha in sugarcane based cropping system. Higher wheat yield (46.9 q/ha) was recorded in sugarcane based cropping system just after harvest of ratoon crop as compared to 35.9 q/ha in rice-wheat system. Residue retention with *Trichoderma* in wheat improved the wheat yield by 11.2% in rice-wheat based cropping system. However, trash mulching with *Trichoderma* in ratoon crop improved the cane yield by 9.5% as compared to mulching without *Trichoderma*.

5. PANTNAGAR

Highest cane yield and wheat yield in ratoon recorded in T5 – Trash mulching with *Trichoderma*. Sucrose % in ratoon at harvest was not influenced by trash mulching or removal. There was no significant difference in organic carbon build up in any of the treatment however highest organic carbon % was recorded in T5 – sugarcane-ratoon (trash mulching with *Trichoderma*) – wheat.

6. UCHANI

Higher cane equivalent yield was recorded in Sugarcane plant- ratoon-wheat cropping system as compared to Rice-wheat cropping system. Highest cane equivalent yield of 115.4, 115.0 and 110.0 t/ha was recorded in treatment T7 (sugarcane – Ratoon- Wheat (ZT) without Trichoderma, T5 (sugarcane – Ratoon (trash mulch with Trichoderma) – Wheat) and T3 (sugarcane – Ratoon (trash mulch without Trichoderma) – Wheat). Physical properties of soil were adversely affected in treatment T1 and T2 after harvest of puddled transplanted rice. The bulk density increased from 1.63 (initial) to 1.72 Mg/m^3 after harvest of rice crop. The bulk density and WHC improved after rice residue retention in wheat crop through happy seeder machine in treatment T1 and T2. Sugarcane proved superior in maintaining soil physical properties in comparison to puddled transplanted rice- wheat rotation.

PENINSULAR ZONE

1. PADEGAON

During 2017-18 soybean grain yield recorded in treatment T1 was 10.6 q/ha and T2 11.6 q/ha while wheat grain yield was recorded in T1 was 29.39 q/ha and T2 was 31.01 q/ha. Mean sugarcane ratoon yield was observed to be 72.9 t/ha to 100.8 t/ha.

2. NAVSARI

NMC (111430/ha) was recorded significantly higher with treatment T5 over T7 and remained at par with T3. Cane length and cane diameter at harvest was failed to show any significant effect due to different treatments. Single Cane weight was recorded significantly highest with treatment T5 and remained at par with T3, T6 and T7. Significantly highest Cane yield (121.17 t/ha) was noticed with treatment T5 over T7 and remained at par T3. CCS yield was not significantly influenced due to different treatments.

3. MANDYA

In the second year sugarcane was ratooned in T2 to T7 treatment and soybean-maize was grown in T1 treatment. All the sugarcane treatments recorded on par yield and yield attributing parameters and in soybean-maize treatment soybean yield was 16.5 q/ha and maize yield was 85.0 q/ha (Table AS 71.9.1). Soil chemical parameters viz., soil pH, EC, OC, BD and soil available N, P2O5 and K2O content after the harvest of ratoon crop were not influenced significantly due to different cropping systems.

4. THIRUVALLA

Sugarcane-Ratoon (trash mulching with Trichoderma)-cowpea recorded the maximum cane length (260.68 cm), cane diameter (2.47 cm), single cane weight (1.70 kg) etc. and resulted in significantly higher cane and sugar yield (77.17 and 8.23 t/ha respectively) followed by T6 - Sugarcane-ratoon-cowpea(trash incorporation through rotavator and Trichoderma incorporation before sowing of cowpea) which recorded the values of 254.33 cm, 2.41 cm, 1.65 kg and 69.65 and 6.81 t/ha respectively for the said parameters.

5. POWARKHEDA

The significantly highest Sugarcane equivalent yield (246.32 t/ha) was obtained with sugarcane- ratoon (trash mulching with Trichoderma)- wheat followed by Sugarcane-Ratoon (trash mulching without Trichoderma)-Wheat (241.71 t/ha) cropping systems. Among these treatment the equivalent yield recorded at par. The equivalent yield recorded Sugarcane- Ratoon- Wheat (Zero tilled with Trichoderma) (240.49 t/ha), Sugarcane-Ratoon - Wheat (trash incorporation through rotavator and Trichoderma incorporation before sowing of Wheat) (238.11 t/ha), Sugarcane- Ratoon (trash removal without Trichoderma)- Wheat (237.83 t/ha), Sugarcane- Ratoon-Wheat (Zero tilled without Trichoderma) (237.39 t/ha), Sugarcane-Ratoon- Moong bean (236.32 t/ha), Soybean-Wheat (100.51 t/ha). The highest net return (Rs.132951/ha) and B:C ratio(1:1.30) was recorded under Sugarcane-

Ratoon (trash mulching with Trichoderma)- Wheat cropping system then other sugarcane cropping system.

EAST COAST ZONE

1. ANAKAPALLE

Studies on carbon sequestration assessment in sugarcane based cropping system indicated that there is no significant variation in yield and quality of sugarcane ratoon crop in T2 to T8 treatments.

2. CUDDALORE

Sugarcane – Ratoon (trash mulching with Trichoderma) – Maize recorded significantly higher number of millable cane (145600/ha), cane length (286.5 cm) cane diameter (2.14 cm) and individual cane weight (1.71 kg) of sugarcane. The treatment (T5) Sugarcane – Ratoon (trash mulching with Trichoderma) – Maize has significantly recorded the highest cane yield (145.2 t/ha) and sugar yield (17.89 t/ha) and it was on par with Sugarcane – Ratoon – Maize (trash incorporation through rotavator and *Trichoderma* incorporation before planting of Maize) cropping sequence (142.2 t/ha and 17.16 t/ha respectively).

14. NAYAGARH

In the second year cowpea and sesame crop was grown along with ratoon crop to compare with sugarcane based cropping system. The observations on growth parameters and yield and yield attributes were analysed. The ratoon crop with trash mulching with *Trichoderma* produced highest number of net millable canes (90700/ha), cane (94.14 t/ha) and CCS yield (11.34 t/ha).

NORTH CENTRAL ZONE

1. PUSA

Data on growth, yield attributes, ratoon yield and quality of sugarcane and yield of rice, wheat system and organic carbon content on post-harvest soil indicated that none of treatments except straws yield of wheat could establish significant effect in improving the growth, yield, quality and organic carbon content. However, comparatively higher ratoon cane yield (82.0 t/ha) was obtained with sugarcane-ratoon-wheat (trash incorporation through rotavator and Trichoderma incorporation before sowing of wheat) (T6). Comparatively higher grain (3.73 and 3.91 t/ha) and straw yield (4.80 and 5.40 t/ha) of rice and wheat, respectively was obtained with rice-wheat-rice-wheat (residue retention with *Trichoderma* cropping system (T2).

SALIENT FINDINGS

The highest cane yield was recorded in Sugarcane – Ratoon (trash mulching with *Trichoderma*) – cowpea in North West zone, Peninsular Zone and East Cost Zone. Similarly the maximum cane yield was recorded in North Central zone through Sugarcane – Ratoon –Cowpea (with trash incorporation through rotavator and *Trichoderma* before sowing of Cowpea). There was no significant difference in organic carbon build up in any of the treatment except in East coast zone. However, marginal improvement over initial status was recorded with trash incorporation along with *Trichoderma* inoculation. (Table 1.1 & 1.2) at some of the centres.

Table 1.1/AS 71: Effect of carbon sequestration assessment on yield of sugarcane and organic carbon

Treatment	North west zone (6)		North central zone (1)	
	Yield (t/ha)	% OC	Yield (t/ha)	% OC
T1: Rice-wheat-rice-wheat (residue retention without *Trichoderma*)	-	0.56	-	0.51
T2: Rice-wheat-rice-wheat (residue retention with *Trichoderma*)	-	0.57	-	0.51
T3: Sugarcane – Ratoon (trash mulching without *Trichoderma*) – cowpea	95.50	0.57	75.3	0.51
T4: Sugarcane – Ratoon (trash removal without *Trichoderma*) – cowpea	90.08	0.56	75.2	0.50
T5: Sugarcane – Ratoon (trash mulching with *Trichoderma*) – cowpea	**95.67**	0.57	74.0	0.51
T6: Sugarcane – Ratoon –cowpea (trash incorporation through rotavator and *Trichoderma* incorporation before sowing of cowpea)	92.82	0.57	**82.0**	0.53
T7: Sugarcane – Ratoon- cowpea (Zero tilled) without *Trichoderma*	95.12	0.56	79.3	0.52
T8: Sugarcane – Ratoon- cowpea (Zero tilled) with *Trichoderma.*	90.48	0.56	76.5	0.52
CV (%)	5.54	2.03	NS	-
SE(d)	2.98	0.008	-	-
LSD at 5%	NS	NS	-	-

Table 1.2/AS 71: Effect of carbon sequestration assessment on yield of sugarcane and organic carbon.

Treatment	Peninsular Zone (5)		East coast zone (3)	
	Yield (t/ha)	% OC	Yield (t/ha)	% OC
T1: Rice/soybean-maize/wheat/toria	-	0.62	-	0.36
T2:Sugarcane-Ratoon-moong bean/ cowpea / urd bean	111.83	**0.71**	98.08	0.39
T3: Sugarcane – Ratoon (trash mulching without *Trichoderma*) – cowpea	115.40	0.59	100.22	0.38
T4: Sugarcane – Ratoon (trash removal without *Trichoderma*) – cowpea	110.82	0.57	99.77	0.37
T5: Sugarcane – Ratoon (trash mulching with *Trichoderma*) – cowpea	**120.13**	0.57	**106.59**	0.41
T6: Sugarcane – Ratoon –cowpea (trash incorporation through rotavator and *Trichoderma* incorporation before sowing of cowpea)	113.12	0.60	102.21	0.42
T7: Sugarcane – Ratoon- cowpea (Zero tilled) without *Trichoderma*	108.27	0.60	97.02	0.42
T8: Sugarcane – Ratoon- cowpea (Zero tilled) with *Trichoderma.*	109.74	0.60	97.28	0.43
CV (%)	4.08	12.60	3.22	3.13
SE(d)	2.91	0.05	2.63	0.01
LSD at 5%	6.08	NS	5.74	0.03

% SOC : percent soil organic carbon

IMPORTANT OBSERVATIONS

- In the north-west zone, use of sugarcane trash as mulch with or without *Trichoderma* inoculation in the ratoon crop resulted in highest sugarcane equivalent yield and brought about palpable improvement in soil health indicators.
- Trash mulching along with the use of *Trichoderma* in ratoon crop yielded in highest cane equivalent yield of the system comprising sugarcane- ratoon-cowpea/ greengram crops in peninsular and east-coast zones.
- For north central zone, ratavator operation after ratoon harvest followed by spray of *Trichoderma* resulted in highest cane equivalent yield in sugarcane –ratoon – wheat cropping system.

AS-72: Agronomic performance of elite sugarcane genotypes

The trial was initiated during 2016-17 and was allotted to all the centres. During the year (2017-18), 21 centres reported the results. Centre wise summaryof findings for the year 2017-18 are given below:

NORTH WESTERN ZONE

1. FARIDKOT

The yield was significantly better at 90 cm spacing than 120 cm spacing. The number of shoots and millable canes were better at 90 cm spacing but single cane weight was better at 120 cm spacing. The mean highest cane yield in *Early group* was of CoPant 12221 (126.6 t/ha) followed by CoLk 12203 (107.6 t/ha).among mid late ***group*** the highest cane yield was of CoS 12232 (120 t/ha) followed by CoPant 12226 (119.4 t/ha), CoPb 12211 (115 t/ha) and Co 12029 (113.7 t/ha).

2. KOTA

Among the early genotypes Co 12027 recorded significantly higher germination (46.47 %), tillers count (140.13 '000/ha), cane yield (87.10 t/ha), brix (20.37 %), Sucrose (17.83 %), CCS (12.28 %) and CCS yield (10.70 t/ha) over CoJ 64 (zc) and Co 0238 (zc). However, CoLK 12203 also maintained its superiority over other genotypes in terms of cane quality during 2017-18. Among midlate genotypes CoPant 12226 recorded significantly cane yield (93.50 t/ha) over CoS 12232, CoPant 97222 (zc), CoPb 12211 and was at par with CoH 12263 and CoLK 12205.

3. KAPURTHALA

Early genotypes, CoLk 12203, Co Pant 12221 and Co 0238 were having statistically similar germination % but genotype CoLk 12203 recorded highest germination among genotypes. Genotype Co 12027 produced the highest CCS that was statistically at par to genotypes CoJ 64 and Co 238 but significantly higher over other genotypes. Mid-late genotypes, Co Pant 97222 produced significantly higher cane yield.

4. LUCKNOW

Among all early maturing promising sugarcane genotypes including zonal check under test, the genotype CoLk 12203 proved the highest cane and sugar yields /ha due to higher tillering, NMC, girth and weight of single cane. But it could not perform well particularly in respect to juice quality parameters viz, ^{0}brix and sucrose content compared to the performance level of zonal check variety Co 0238 and CoJ 64. *Among mid-late* the cane yield (t/ ha) was highest in genotype Co Pant 97222 sown at 90 cm spacing. The CCS (t/ha) at 10 month stage was significantly higher in CoS 12232 planted at 120 cm spacing over all the genotypes.

5. PANTNAGAR

None of the proposed early genotypes were at par or higher than Co 0238 in cane yield, individual cane weight and CCS yield. Among all the 9 genotypes (mid late), genotype Co pant 12226 performed better than others except Co 12029. The highest cane yield was recorded from Co Pant 12226 which produced significantly higher over rest of the genotypes except Co 12029. CCS yield and sucrose % were also higher in these genotypes (Co Pant 12226 and Co 12029).

6. SHAHJAHANPUR

In early genotypes, CoLK 11202 and in mid – late genotypes CoLK 11206 produced significantly higher cane yield than standards and other entries viz. 107.00 t/ha and 101.40 t/ha, respectively. Row spacing of 90cm was found superior to 120 cm spacing in cane yield under both early and mid – late genotypes with cane yield of 99.90/ha and 93.89 t/ha, respectively.

7. UCHANI

Significantly higher number of tillers, number of millable canes, cane yield and sugar yield were recorded at 90 cm spacing as compared to 120 cm spacing irrespective of the maturity group. Among early maturing varieties, CoLk 12203 (89.9 t/ha), CoPant 12221(90.1 t/ha) and Co 0238 (91.2 t/ha) being at par produced significantly higher cane yield and sugar yield as compared to rest of the varieties. Among mid late varieties, CoS 12232 (100.2 t/ha), CoPant 97222 (99.2 t/ha), CoPant 12226 (96.7 t/ha) and Co 12029 (93.5 t/ha) being at par recorded significantly higher cane yield and sugar yield as compared to rest of the varieties.

PENINSULAR ZONE

1. PADEGAON

Among early genotypes, Co 11001 was found superior for cane yield and genotype Co 94008 for CCS yield than the other genotypes. For the mid-late genotypes, Co 11005 was found significantly superior for Cane yield and Co 86032 for CCS yield than the other genotypes. Genotype Co 11012 recorded significantly the highest Sucrose %, Purity % and CCS% as compared to the other genotypes.

2. PUNE

The results of the plant crop indicated that, the early genotype Co 10026 found better with maximum germination (67.78 %), tillering (0.90 lakh/ha), single cane weight (2.13 kg), cane girth (10.66 cm), Cane yield (125.33 t/ha), CCS yield (17.74 t/ha) and B:C ratio (1:2.63), which was found superior in juice quality than check variety CoC 671 and Co 86032.The mid-late genotype Co 10015 performed better in case of NMC (0.96 lakh/ha) while Co 10033 found better with tillering (0.96 lakh/ha), Cane yield (177.00 t/ha), CCS yield (22.72 t/ha), B:C ratio (1:3.45) and also superior in juice quality than both the check variety.

3. MANDYA

Among the elite early genotypes, CoM 11082 recorded significantly higher cane yield (127.97 t/ha) as compared to others. But, it was on par with CoM 11084 (123.00 t/ha) and Co 11001 (120.09 t/ha).Among elite mid-late genotypes, Co 11012 found superior with respect to cane yield (160.9 t/ha) as compared to others. But, was on par with Co 11019 (155.3 t/ha) and CoM 11086 (154.6 t/ha).

4. NAVSARI

In early group significantly highest cane yield (137.20 t/ha) was recorded with variety C0 11082 over checks and remained at par with varieties. Variety V4 (Co11082) recorded significantly highest CCS yield (19.26 t/ha) over checks Significantly highest cane yield (129.97 t/ha) was recorded with variety V6 (CoM 11086) over checks.

5. KOLHAPUR

Genotype CoM 11082 recorded highest cane yield (98.0 t/ha) and CCS yield (15.55 t/ha) among the early genotypes. Among mid-late genotypes Co 11019 (94.67 t/ha and 14.87 t/ha), Co 11007 (89.67 t/ha and 10.53 t/ha) and CoM 11086 (89.33 t/ha and 12.68 t/ha) recorded higher but statistically at par cane and CCS yield, respectively over best standard Co 86032.

6. SANKESHWAR

Among early genotypes significantly higher cane yield (90.58 t/ha), single cane weight (1.63 kg) and CCS yield (11.49 t/ha) was recorded in CoM 11082 and was on par with Co 11001 (86.86 t/ha) and Co 85004 (C) (79.36 t/ha). Significantly higher cane yield (91.72 t/ha) and CCS yield (11.17 t/ha) was recorded in Co 86032 and was on par with CoM 11019 (71.47 t/ha) and CoM 11086 (85.57 t/ha) in mid-late genotypes. The highest values were recorded in CoM 11019 for brix% (23.09), POL% (19.52) and CCS% (13.21).

7. THIRUVALLA

In the case of early varieties, the germination % and tiller count were influenced significantly by the various genotypes and the highest values for the said parameters were recorded by CoM 11082 followed by Co 94008 under both the spacing (120 and 150 cm). With regard to mid-late varieties the highest values for cane length, cane diameter, single cane weight, MCC, cane yield and sugar yield were recorded by Co11007 followed by Co 86032.

EAST COAST ZONE

1. ANAKAPALLE

Among the five new early genotypes COV 13356 recorded significantly higher cane yield of 88.2 t/ha as compared to the genotype CO C 13337 (72.7 t/ha) and found on par

with COC 13336 (87.8 t/ha) and COA 13322 (84.1 t/ha). Among the four new mid late genotypes Co A 11326 recorded higher cane yield of 86.8 t/ha followed by COV 13356 (86.7 t/ha) than that of the check genotypes CoV92102 (81.3 t/ha) and Co 86249 (82.0 t/ha).

2. CUDDALORE

The results revealed that the early genotype CoC 13336 recorded the significantly highest economic shoot of 130250/ha, millable cane population of 122250/ha, cane weight (1.34 kg), cane length (295.7 cm) and cane diameter (2.97 cm).The genotype also recorded significantly the highest cane yield (143.3 t/ha) and sugar yield (17.83 t/ha) and it was on par with the new entry CoC 13337.

3. NAYAGARH

Analysis of variance suggested that there is significant variations among the early genotypes CoA 13323 produced the highest average cane yield of 102.34 t/ha with application of 125 % RD of fertilizer and was closely followed by CoA 13322 (100.45 t/ha) and CoV 13356 (98.64 t/ha). *Among Mid-late* genotype CoOr 13346 produced the highest average cane yield of 101.5t/ha with application of 125 % RD of fertiliser and was closely followed by CoA 13324 (99.7 t/ha) and CoA 11326 (98.64 t/ha).

NORTH CENTRAL ZONE

1. PUSA

Early genotype CoSe 95422 noticed maximum cane yield (104.4 t/ha) which was followed by CoSe 12451 (94.04 t/ha) and CoLk 12207 (91.8 t/ha). Though higher sucrose content in juice was obtained with the genotype CoLk 12207 (18.13 %) which was statistically similar to BO 130 (Std.). The maximum cane yield of 106.7 t/ha was obtained with the mid-late genotypes CoLk 09204 which was followed by BO 91 (Std.) and CoSe 12453. Though, maximum sucrose content juice (18.04 %) was noticed with the genotype CoP 9301 which was followed by CoLk 09204 (17.39 %) and BO 91 (17.29 %).

2. SEORAHI

Among tested genotypes, maximum sucrose per cent value was obtained in CoSe 11454 in mid-late and CoP 11437 in early group genotype. The treatment with 90 cm row spacing gave significantly higher yield as compared to 120 cm row spacing. Sucrose per cent was not affected significantly with different treatments of spacing but maximum value was obtained in 120 cm row spacing treatments in both mid-late and early group of genotypes.

NORTH EASTERN ZONE

1. BURALIKSON

Among the early varieties local check (CoBln 9101) recorded the higher yield (62.21t/ha) than all the other varieties. However, among the tested varieties, CoLk 12207 (52.22 t/ha) performed better than all other tested varieties. Among mid-late, varieties local check (CoBln9605) recorded the higher yield (60.84 t/ha) than all the other varieties. However, among the tested varieties, CoLK 09204 (58.82t/ha) recorded the higher yield which is statistically at par with the yield recorded by CoP 9301 (Check) (58.80 t/ha).

Important Observations

Best performing genotypes across the centres located in different zones are listed herewith:

Sl. No.	Zone	Early genotypes	Mid-late genotypes	Spacing
1	North Western	CoPant 12221, CoLk 12203, Co 12027, Co 12026	CoPant 12226, CoPb 12211, CoS 12232, Co 12029, CoLk 12205, CoH 12263,	At almost all the centres cane yield at 90 cm spacing was significantly superior over that of 120 cm.
2	Peninsular	Co 11001, CoM 11081, CoM 11082, CoM 11084	Co 11005, CoM 11085, Co 11012, Co 11019, CoM 11086, Co 11007	Except Thiruvalla all the centres planted at 150 cm spacing.
3	East Coast	CoC 13336, CoA 13323, CoA 13322	CoOr 13346	No variation in inter-row spacing
4	North Central	CoSe 12451, CoLk 12207	CoSe 12453, CoLk 09204	Significant yield improvement with at closer spacing (90 cm).
5	North Eastern	All genotypes performed below the performance of check varieties.	Most of the genotypes performed similar and below the performance of of check varieties except CoLk 09204.	Significant yield improvement with at closer spacing (90 cm).

Summary

- Addition of 20 t/ha FYM/ compost along with inorganic fertilizers applied on the basis of soil test crop response for targeted yield or on the basis of general recommendation for the region has shown positive effect on sugarcane growth and yield both in plant and ratoon crops. Response of bio-fertilizers (*Azotobacter*/ *Acetobacter*/ *Azospirillum*/ PSB) was more pronounced in peninsular zone.

- Efficacy of ethrel on accelerating and enhancing germination in sugarcane has been reported from almost all the centres and 50 ppm solution was found equally effective as 100 ppm. Spray of GA_3 (35 ppm) during tillering enhanced cane yield effectively across the zones. However, for north west zone, sett soaking in ethrel performed equally well and there was no additional yield increment with GA_3 spray during tillering phase.

- Planting of sugarcane in paired rows (120: 30) with mulching of trash (6 t/ha) in the inter-row spaces out yielded the conventional flat method with or without mulch at all the centres in north western, north central and north eastern zones. Being in the climatic region of high evaporative demand, sugarcane crop responded up to 1.0 IW/CPE irrigation regime in the zones. However, similar yields have been recorded with 0.8 IW/CPE ratio at most of the centres. Trash mulching could effectively save 20-26% irrigation water over no-mulching.

- Sugarcane crop in peninsular and east coast zones responded to furrow planting (120 cm) and skip furrow irrigation combined with the use of leguminous crop as green manure till 75 DAP, as a mulch during tillering and thereafter residue incorporation. As far irrigation regimes, IW/CPE ratio 1.0 was resulted in higher cane productivity. However, it could be restricted to 0.8 for getting higher water use efficiency in these zones.

- Use of mulch in sub-tropical zones and green manuring followed by mulching and residue incorporation resulted in higher net return in tropical zones.

- In the north-west zone, use of sugarcane trash as mulch with or without *Trichoderma* inoculation in the ratoon crop resulted in highest sugarcane equivalent yield and brought about palpable improvement in soil health indicators.

- Trash mulching along with the use of *Trichoderma* in ratoon crop yielded in highest cane equivalent yield of the system comprising sugarcane- ratoon- cowpea/ greengram crops in peninsular and east-coast zones.

- For north central zone, rotavator operation after ratoon harvest followed by spray of *Trichoderma* resulted in highest cane equivalent yield in sugarcane –ratoon – wheat cropping system.

- Best performing **early** genotypes across the different zones are given *viz.*, North Western zones (CoPant 12221, CoLk 12203, Co 12027, Co 12026); Peninsular (Co 11001, CoM 11081, CoM 11082, CoM 11084); East Coast (CoC 13336, CoA 13323, CoA 13322); North Central (CoSe 12451, CoLk 12207) while in **midlate genotypes** North Western zone (CoPant 12226, CoPb 12211, CoS 12232, Co 12029, CoLk 12205, CoH 12263,); Peninsular (Co 11005, CoM 11085, Co 11012, Co 11019, CoM 11086, Co 11007); North Central (CoSe 12453, CoLk 09204). In north eastern zone, both early and mid-late genotypes performed below the performance of check varieties except CoLk 09204 (Mid-late).

3. PLANT PATHOLOGY

Sugarcane is high value income generating crop and supports one of the largest agro-processing industries of the country. The sugarcane cultivation area of the country is likely to be stagnated while productivity and sugar recovery increased significantly. Under AICRP on Sugarcane, sugarcane varieties are released, keeping in view the high tonnage and high sugar content per unit area in addition to resistant to insect-pests and diseases. In Plant Pathology discipline, Initial Varietal Trials and Advanced Varietal Trials were conducted for testing of sugarcane clones to be adopted on large area/region in the country. The programmes are given below and their findings achieved by different AICRP(S) centers discussed.

In Plant Pathology discipline, the following eleven experiments were allotted to different AICRP(S) centers in different sugarcane producing zones of the country. The experiments were conducted during 2017-2018 and results are summarized below.

List of projects implemented during 2017-18

PP 14 & 14 (a): Identification of pathotypes of red rot pathogen

PP 17A: Evaluation of zonal varieties for resistance to red rot

PP 17B: Evaluation of zonal varieties for resistance to red smut

PP 17C: Evaluation of zonal varieties for resistance to red wilt

PP 17D: Evaluation of zonal varieties for resistance to red YLD

PP 22: Survey of sugarcane diseases naturally occurring in the area on important sugarcane varieties

PP 23: Assessment of elite and ISH genotypes for resistance to red rot

PP 28 (b): Methodology for screening sugarcane genotypes for resistance to brown rust

PP 31: Screening, epidemiology and management of pokkah boeng in sugarcane

PP 32: Management of brown spot disease of sugarcane

PP 33: Management of yellow leaf disease through meristem culture

PP 14: IDENTIFICATION OF PATHOTYPES IN RED ROT PATHOGEN

Objective : To gather information on the major pathotypes of red rot from different areas/zones.

Location : **i) North Western Zone :** Lucknow, Shahjahanpur, Kapurthala, Uchani and Karnal (SBI)

ii) North Central Zone : Pusa, Seorahi

iii) East Coast Zone : Anakapalle and Cuddalore

iv) Peninsular Zone : Navsari, Coimbatore, Thiruvalla

Year of Start : 1983-84 (continuing project)

New isolates showing pathogenic variability from the previously reported pathotypes at different centers will be confirmed at the following centres, Lucknow and Uchani (North West Zone), Anakapalle (East Coast zone) and SBI, Coimbatore (Peninsular zone). The participating centres will deposit such working isolates at the above mentioned centres latest by June 15 of each year. The zonal centers will also maintain the type cultures.

Sugarcane differentials (14 + 5): Co 419, Co 975, Co 997, Co 1148, Co 7717, Co 62399, CoC 671, CoJ 64, CoS 767, CoS 8436, BO 91, Baragua (*S. officinarum*), Kakhai (*S. sinense*) and SES 594 (*S. spontaneum*). Five new differentials – Co 7805, Co 86002, Co 86032, CoS 95422 and CoV 92102.

No. of isolates: Virulent isolates collected from red rot affected canes of commercially cultivated varieties in the zone.

Method of inoculation: Plug method of inoculation is to be used (Details vide PP 17). Inoculations with each isolate to be done on all the differentials with freshly prepared spore suspension. All inoculations to be completed in 2 days by last week of August.

Observation: One observation at 60th day after inoculation

Evaluation: The canes are to be split open longitudinally. Inoculated canes free from borer infestation and other damages are taken for evaluation. Based on parameters *viz*. nodal transgression, lesion width, white spots, top yellowing/drying, rind infection and sporulation over the rind, the host reaction is categorized into three groups *viz*., Resistant (R), Susceptible (S) and Intermediate (X) as follows:

R : Lesion width laterally restricted nodal transgression up to 2 nodes, white spots, rind infection, sporulation over the rind and yellowing/drying of tops absent.

S : Lesion width laterally spreading, nodal transgression more than 2 nodes, white spots progressive or restricted in case of progressive white spots, rind infection, sporulation over the rind and yellowing/drying of tops absent or present.

X : Lesion width laterally restricted or spreading: nodal transgression more than 2 nodes; white spots absent or present (restricted type), rind infection, sporulation over the rind and yellowing/drying of tops absent.

RESULTS

NORTH WEST ZONE

1. LUCKNOW

Fifteen new *C. falcatum* isolates *viz*., two isolates from CoS 8436 (IR-145 and IR-146); three isolates from CoSe 95422 (IR-147, IR-148 and IR-152); two isolates from CoS 767 (IR-153 and IR-154); six isolates from Co 0238 (IR-140, IR-141, IR- 143, IR-149 IR-150 and IR-151); and one isolate each from CoS 92423 (IR-144) and CoLk 8102 (IR-142) were evaluated for their virulence on 14 designated differentials. Except the isolates obtained from Co 0238, the virulence pattern of other isolates were more or less matched with the existing pathotypes of this zone. It was observed that Co 0238 isolates have specific virulence on Co 419, intermediate virulence on CoC 671 and no virulence against the differential Co 997. In addition, isolates of Co 0238 have shown intermediate reaction against BO 91 but virulence on Co 62399 and CoS 8436. Thus, indicating the development of a new specific virulence (though has lower spectrum of overall virulence) at this area that is capable of knocking down the popular variety Co 0238.

2. SHAHJAHANPUR

Ten isolatespathotypes of *C. falcatum* were tested on 19 host differentials by plug method. Seven existing pathotypes and three local isolates R 1102 (CoS 8436), R 1304 (CoS 07250) and R 1602 (Co 0238) exhibited pathogenic variability on host differentials. Among all differentialsCo 997 and Khakai exhibited universal susceptibility, whereas and CoSe 95422 and SES 594 exhibited resistance to all isolates. CoS 8436 displayed resistance to all isolates except one isolate R 1102 (CoS 8436) while Co 1148 behaved as susceptible to exiting pathotypes. The resistant variety BO 91 did not exhibit susceptible reaction, it exhibited intermediate reaction to CF09 and R 1102 (CoS 8436) isolates.The varieties Co 419, Co 975, Co 7717, Co 62399, CoJ 64, CoS 767, Co 86002, CoV 92102, CoS 95422, Khakai and SES 594 mostly behaved as isolates R 1102 (CoS 8436) and R 1602 (Co 0238) whereas R 1304 (CoS 07250) behaved differently from these isolates.

3. KAPURTHALA

Seven new isolates *viz*., RI- 307 from CoJ 64 , RI-308 from CoJ 88, RI-309 from CoJ 85, RI-310 from CoPb 91, RI-311 from Co 89003, RI-312 from Co 89003 and RI-313 from Sel. K 2/3 along with two designated pathotypes CF08 and CF09 were inoculated on 19 differentials. Among the isolates RI-307, RI-309, RI-312 and RI-313 were found most virulent and showed reaction similar to pathotype CF08. Two new isolates RI-308 and RI 310 were also found as virulent as pathotype CF08 except intermediate reaction of RI-308 on Co 419 and of RI-310 on Co 1148. Isolate RI-311 behaved quite similar to pathotype CF09 except its intermediate reaction on Co 1148 and S reaction on Co 62399.

4. UCHANI

All the designated pathotypes along with six new isolates RR XXVII (CoJ 64), RR XXVIII (CoJ 85), RR XXVIV (CoJ 64) and RR XXX (CoS 89003) and RR XXXI CoS (CoS 8436), RR XXXII (CoJ 85) collected from Haryana were used for pathogenic variability. Observations recorded indicate that the differentials Co 419, Co 975, Co 1148, Co 7717, Co 62399, CoJ 64 and Co 86002 exhibited a clear cut differential reaction (S/R/I). Isolates RR XXVII, RR XXVIII, RR XXVIV and RR XXXII showed S reaction on Co 419, Co975, Co 997, Co 1148, Co7717, Co 62399, CoC 671, CoJ 64. Isolate RR XXXI showed S reaction on Co 419, Co 975, Co 997, Co7717, Co 62399, CoC 671, CoJ 64, CoS 8436 Khakai and Co 86002 and R reaction onCo 7717,CoS 767 BO 91, SES 594, CoSe 95422, CoV 92102 and Co 86032. Similarly RR XXIV showed pathogenic variation on host differentials with intermediate reaction on CoS 767 and Baragua.

5. KARNAL

A set of fourteen *C. falcatum* isolates comprising seven designated pathotypes and seven isolates collected from CoS 8436 (3), BO 138 (1), CoSe 95422 (1), CoBln 05521(1) and Co 89903 (1) were inoculated independently on a set of twenty sugarcane differentials by plug method of inoculation. The overall disease reaction indicated that there was a clear pathogenic variation on the host differentials. The pathogenic reaction indicated that among the designated pathotypes, CF11 found to be most virulent followed by CF07, CF02, CF01, CF08, CF09 and CF03. Of the three Cf8436 isolates, Cf8436 (Karnal) exhibited virulence on the differential CoS 8436 with intermediate to susceptible reactions on 11 host differentials. Another new isolate Cf89003 collected from variety Co 89003 was also virulent and expressed intermediate to susceptible reactions

on 12 host differentials, suggests the possible emergence of new pathotype in subtropics. Further, three isolates viz. CfBLN 05521, CfBO138 and CfSe 95422 exhibited intermediate reaction to some of the host differentials, whereas differential SES 594 showed complete resistance to all the test isolates.

NORTH CENTRAL ZONE

1. PUSA

Ten sugarcane differentials were inoculated with two pathotypes CF07 and CF08 and ten isolates collected from different cane growing areas of Bihar. Twenty five canes of each differential were inoculated and disease progress was assessed. The result indicated that the differentials Co1148 and Khakai produced susceptible reaction whereas, differential BO 91 and SES 594 showed resistant reaction while, differentials Co 419, CoS 8436, Co 62399, Co 975, CoV 92102 and CoSe 95422 showed differential reaction against all the test isolates.

2. SEORAHI

Seven pathotypes *viz*. CF01, CF02, CF03, CF07, CF08, CF09 and CF11 along with 5 isolates, R1101Seo (CoLk 8102), R1201Seo (CoS 8436), R1301Seo (CoS 07250), R1601Seo (CoSe 92423) and R1602Seo (UP 9530) were inoculated in 19 differentials. The virulence pattern of the isolates was found more or less similar with the existing pathotypes of this zone and no emergence of any new virulent pathotype was noticed).

EAST COAST ZONE

1. ANAKAPALLE

Eight isolates of *C. falcatum* collected from sugarcane cultivars, Co 419, Co 997, CoC 671, CoA 89085, CoOr 12346, Co 62175, CoV 89101 and Co 6907 were tested for their pathogenic variability on a set of 19 host differentials. Most of the isolates were unable to infect the differentials, viz., Co 975, Co 1148, Co7717, CoJ 64, CoS 767, CoS 8436, BO 91, Baragua, SES 594 and CoSe 95422. Only the isolates recovered from Co 997 and CoA 89085 have produced an intermediate reaction on the host differential CoJ 64. The reaction of the isolates collected from Co 62175 and CoOr 12346 was found to be similar to the existing pathotype CF06. The reaction of the isolate Co 6907 was similar to pathotype CF05, except that it couldn't breach the resistance of Co 419, CoJ 64 and Co 86002. The isolate, Co 6907 was found to be less aggressive compared to other isolates tested. The reaction of the isolate CoV 89101 was found to be similar to the pathotype CF04.

2. CUDDALORE

Sugarcane differentials were inoculated with the *C. falcatum* isolated from varieties *viz.*,CoC 23, CoC 24, Co 91017, CoSi 6, TNAU Si 8 and designated pathotype CF06. Among the differentials, in BO 91, the isolate from CoC 24 exhibited intermediated reaction while all other isolates registered R reaction. Similarly in Co 1148, the isolate from CoC 24 showed S reaction while it was R to CF06. In the differential CoJ 64 the isolate from CoC 24 showed S reaction while it was I to CF06. All these reactions indicated the isolate from CoC 24 exhibited limited variation from designated pathotype CF06. The isolates from CoC 23, Co 91017, CoSi 6 and TNAU Si 8 have shown reaction similar to CF06.

PENINSULAR ZONE

1. NAVSARI

Four isolates collected from CoC 671 (CF06), Co 86032(Cf86032), Co 86002 (Cf86002) and CoC 671 (New isolate-1) were inoculated on 19 differentialsand the results revealed that CoJ 64, CoS 8436, BO 91, Baragua, SES 594 and CoSe 95422 showed R reaction for all the isolates.The differentials Co 1148, Khakai and CoV 92102 exhibited I reaction to all the isolates,while, Co 62399 and Co 767 showed I reaction to CF06 and R reaction to Cf86032, Cf86002 and New isolate-1, respectively. The differential Co 975 showed I reaction to CF06 and S reaction to Cf86002, Cf 86032 and New isolate-1. Only one differential Co 86002 showed mix reaction against isolate i.e., intermediate reaction to CF06 and Co 86032 and S reaction to two isolates (Cf 86002 and new isolate-1), while Co 997 and CoC 671 showed S reaction to all the isolates.

2. COIMBATORE

Seven new isolates from Tamil Nadu *viz* CfPI1110 Kothangudi, CfPI1401 Kadaganur, Cfv09356 Keerangudi, Cf86027 Nathakadu, Cf2001-13 Perambakkam, Cf06022-Kuthalam and Cf99006 Mundiampakkam along with two reference pathotypes CF06 and CF12 were tested on 19 differentials. The new isolates showed less virulence than reference pathotypes, however three new isolates viz., Cf2001-13- Perambakkam, Cf06022- Kuthalam and Cf99006- Mundiampakkam exhibited different reaction from CF06 on many differentials. The differential CoSe 95422 exhibited I reaction to three isolates and two reference pathotypes this season. Unlike previous season, this time both the reference pathotypes CF06 and CF12 showed similar disease reaction on all the differentials. Pathogenic reactions of the isolates indicated some changes induced by the environmental factors prevailed during the period.

3. THIRUVALLA

Four new isolates *viz*., Cf 86027 (Nathakadu), Cf 2001-13 (Perampakkam), Cf 06022 (Kuthalam), Cf 99006

(Mundiampakkam) and three old isolates *viz*., CfPI1110 (Kothangudi), CfPI 1401 (Kadaganur), CfV 09356 (Keerangudi) along with the designated pathotypes CF06 and CF12 were inoculated and tested against nineteen differentials. The disease development on different differentials indicated that, among the isolates, CF12 behaved differently from the reference pathotype CF06 and was found to be the most virulent one. The isolate CfPI1401 (Kadaganur) showed almost similar reactions to that of CF12. The isolates CfPI1110 (Kothangudi), CfPI1401 (Kadaganur), CfV09356 (Keerangudi), Cf 86027 (Nathakadu) exhibited more or less similar reactions to that of CF06 whereas the isolates Cf2001-13 (Perampakkam), Cf06022 (Kuthalam) and Cf99006 (Mundiampakkam) showed less virulent reaction than that of the standard pathotype CF06.

PP17: EVALUATION OF ZONAL VARIETIES FOR RED ROT, SMUT, WILT AND YLD

PP 17A: EVALUATION OF ZONAL VARIETIES FOR RED ROT

Objective : To gather information on the relative resistance to red rot in entries of Pre-zonal varietal trial/zonal trials of the respective zones.

Locations

North West Zone : Lucknow, Kapurthala, Uchani, Shahjahanpur, Karnal, Pantnagar

North Central Zone : Pusa, Motipur, Seorahi and Bethuadahari

East Coast Zone : Anakapalle and Cuddalore

Peninsular zone : Thiruvalla, Navsari, Coimbatore

Year of start : 1986-87 (Continuing project)

Varieties: All the centres will test all the entries of early and midlate groups under IVT and AVT of the respective zones. Entries of Inter zonal varietal trial (IZVT) are also to be tested, if listed. The seed material for this programme is to be obtained from the respective breeders of the centres. One 6 metre row of at least 20 clumps for inoculation with each pathotype by plug/nodal method. Any red rot susceptible variety of the same maturity group may be used as standard (check).

Inoculum : (Pathotypes to be used):

North West Zone : CF08 &CF09 (To be inoculated separately)

North Central Zone : CF07 &CF08 (To be inoculated separately)

East Coast Zone : CF04 &CF06 (To be inoculated separately)

Other Zones : Two widely occurring isolates on commercial varieties in the area.

(**Note:** If pathotypes are not available, CF07, CF08 and CF09 may be obtained from IISR, Lucknow and CF04 &CF06 from RARS, Anakapalle).

Freshly sporulating 7 day old culture in Petri dishes will be taken. The spore mass will be washed with 100 ml of sterile water and collected in a flask. Conidial suspension at a spore concentration of one million spores per ml will be prepared for inoculation. Fresh inoculum should always be used for inoculation.

Methods of inoculation

Plug Method: Two canes in each of the 20 clumps to be inoculated. Inoculation is to be done in the middle of the 3rd exposed internode from bottom and two drops of the spore suspension are to be placed with a large syringe in each cane and sealed with plastic clay (plasticine) or modeling clay.

Cotton Swab Nodal Method: (All the centres) Two canes in each of 20 clumps will be inoculated by removing leaf sheath (lower most green leaf sheath) and immediately placing cotton swab (dipped in freshly prepared inoculum suspension) around the cane covering nodal region. The cotton swab should be held in place by wrapping parafilm® over the swab.

Evaluation

Cotton Swab Nodal method: One observation at the end of 60 days after inoculation. Observe for spindle infection i.e. presence of mid rib lesions with or without conidia, presence of acervuli at nodes specially on leaf scar, root primordial and growth ring. Record the intensity of the acervuli at node. Scrap the node and see if lesions are developing into stalks. Wherever lesions are progressive towards susceptibility the entries are rated as susceptible. If the lesions are dark and restricted to rind tissues, the clones are rated as resistant. Atleast 15 stalks are to be evaluated to assess disease reaction.

Plug method: The canes to be split open longitudinally sixty days after inoculation along the point of inoculation. Inoculated canes free from borer infestation and other damages are taken for evaluation. This is graded on the international scale of 0-9 as follows:

Variety/ genotype ---------- Method of inoculation ----------

No. of canes evaluated	Condition of tops*	Lesion width**	White spot (WS)***	Nodal transgression (NT)****	Total score	Remarks
1.						
2 to						
15						

*1. Condition of top: Green (G) – 0, Yellow (Y)/Dry (D)-1
**2. Lesion width above inoculated internode is assigned the score of 1, 2 or 3
***3.White spot assigned score of 1 or 2 according to whether it is restricted or progressive
****4.N.T. No. of nodes crossed above the inoculated internode and given the score as:

1 if one node is crossed

2 if two nodes are crossed

3. if three nodes are crossed (maximum) or more

Average Score = Total Score/No. of canes evaluated

Disease reaction: 0-9 Scale

0.0 to 2.0 -R
2.1 to 4.0 -MR
4.1 to 6.0 -MS
6.1 to 8.0 -S
8.0 to 9.0 -HS

Note: Average score is taken into account for assigning the disease reaction.

The varieties which show susceptibility by plug method, but have not shown nodal susceptibility are to be retested by nodal method. If these are not susceptible by the nodal method, they may be considered for release.

RESULTS

NORTH WEST ZONE (Table 1 and 2)

1. LUCKNOW

In IVT (Early), two genotypes viz., Co 14034 and CoLk 14202 were found R and five genotypes viz., CoLk 14201, CoPant 14221, CoPant 14222, CoPb 14181 and CoPb 14182 were found MR against both the pathotypes (CF08 and CF09). CoPb 14211 was rated MS against pathotype CF08 and MR against CF09. In AVT (Early)–I Plant, two genotypes viz., Co 13034 and CoPb 13181 were found MR by plug method against both the pathotypes and CoS 13231 was found MR against CF08, whereas S to CF09. In AVT (Early)-II Plant, Co 12027 was R and CoLk 12203 was MR against both the pathotypes,whereas, CoPant 12221 was MS and Co12026 was S against both the pathotypes. In IVT (Mid late), out of 15 genotypes evaluated, CoLk 14205 was R and thirteen genotypes viz., Co 14035, Co 05011, CoH 14261, CoH 14262, CoLk 14203, CoPant 97222, CoLk 14204, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14232 and CoS 14233 were MR against both the pathotypes. In AVT (Mid late)-I Plant all the five genotypes viz., Co 13035, CoH 13263, CoLk 13204, CoPant 13224 and CoPb 13182 were rated as MR against both the pathotypes.InAVT (Mid late)-II Plant, four genotypes viz., Co 12029, CoH 12263, CoLk 12205, and CoS 12232 were found MR to both the pathotypes.

2. SHAHJAHANPUR

A total of three entries were screened in AVT (Early) I plant and the result revealed that two entries Co 13034, CoS 13231 were found MR by plug method and R by nodal method against the pathotypes CF08. While one entry CoS 13231 evaluated as MR by plug method and all three entries behaved as R by nodal cotton swab method against CF09. In AVT (Early) II plant, all the four entries were identified as MR by plug method and R by nodal cotton swab method against pathotype CF08 and three entries were found MR to CF09 except Co12026. In AVT (Mid late) I Plant, out of five entries, two Co 13035, CoPb 13182 were rated as MR by plug method against CF08 and CF09. One entry CoPant 13224 also evaluated as MR to CF09 by plug method whereas these three entries behaved as R by nodal cotton swab method against both pathotypes. In AVT (Mid late) II Plant, three entries identified as MR against CF08 and three entries found as MR against CF09 by plug method. All the six entries were rated as R by nodal cotton swab method against both pathotypes. In IVT (Early), all entries were found as MR and Co14034, CoPb 14211 were rated as MS by plug method to CF08 pathotypes and CoPb 14181 as MS against CF09. All the seven entries screened as R by nodal cotton swab method against both pathotypes. In IVT (Mid late), of thirteen entries, eleven were found MR, whereas two entries namely CoH 14262 and CoPb 14183 were rated as R and MS, respectively by plug method of inoculation to CF08, while nine entries of this trial were rated as MR by plug method to CF09 and all entries were identified as R by nodal cotton swab method.

3. KAPURTHALA

Thirty-eight genotypes along with standards were tested against red rot pathotypes CF08 and CF09 separately by plug and nodal cotton swab methods. In IVT (Early) six genotypes *viz*., CoLk 14201, CoLk 14202, CoPant 14222, CoPb 14181, CoPb 14182, CoPb 14211 behaved as MR/R by plug and nodal cotton swab methods against both the pathotypes. In AVT (Early) Plant I only CoS 13231 behaved

as MR/R by both the methods of inoculation. In AVT (Early) Plant II, two genotypes (Co 12026 and Co 12027) showed MR/R reaction. In IVT (Mid late), eleven entries viz., Co 14035, Co 14261, Co 14262, CoLk 14203, CoLk 14204, CoLk 14205, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212 and CoS 14232 were found MR/R by plug and nodal cotton swab method against both the pathotypes. In AVT (Mid late) Plant I, two entries (CoPant 13224 and CoPb 13182) behaved as MR/R. In AVT (Mid late) Plant II, three entries namely Co 12029,CoPant 12226 and CoPb 12211 found MR/R by plug and nodal cotton swab method with both the pathotypes.

4. UCHANI

In AVT (early) Plant-I two entries viz., Co 13034 and CoS13231 showed MR/R reaction by plug and nodal cotton swab methods against both pathotypes. In AVT (early) Plant-II genotype CoPant 12221 was found MR by plug and R by nodal cotton swab methods against CF08 and CF09 pathotypes. Entries Co 12027 and CoLk 12203 showed MR reaction against CF08 and MS against CF09 by plug method but R reaction by nodal cotton swab methods against both pathotypes. In AVT (mid late) three enteries viz.,Co 13035, CoH 13263 and CoPb 13182 were MR reaction by plug and R reaction by nodal cotton swab methods against CF08 and CF09. The entry CoLk 13204 showed MS reaction by plug method and R reaction by nodal cotton swab methods of inoculations to both CF08 and CF09.In AVT (mid late) plant-IIthree entries viz., Co 12029, CoH 12263 and CoPant 12226 showedMR reaction by plug and R reaction by nodal cotton swab methods against CF08 and CF09. Two enteries CoLk 12205 and CoPb 12211 showed MS/S reaction by plug method and R reaction by nodal cotton swab methods against CF08 and CF09. In IVT (early) six enteries viz., Co 14034, Co Lk 14201, CoLK 14202, CoPant14222 and Co Pb14181 showed R/MR reaction by both the methods of inoculations to both pathotypes, whereas CoPb14211,was found MS by plug and R by nodal cotton swab methods against CF08 and CF09. In IVT (mid late) ten entries viz., Co 14035,CoH 14261,CoH14062, CoLk 14204, CoPb 14183, CoPb 14184, CoS 14231,CoS 14232 and CoS 14233 showed R/MR reaction both methods of inoculations to both pathotypes except CoS 14232 which showed R reaction by plug method of inoculation.

5. KARNAL

Thirty eight zonal varieties along with standards were evaluated for red rot resistance against CF08 and CF09 isolates. One IVT (E) clone CoPb 14211 exhibited MS reaction to both CF08 and CF09 pathotypes by plug method, while two IVT (ML) entries (CoS 14231 and CoS 14233) were S to CF08 by plug and cotton swab methods and also MS with CF09 isolate. Two entries viz. CoPb 13181 (AVT E-I plant) and CoPb 12211 (AVT ML-II Plant) expressed S to CF08 by plug method. However, remaining entries were R/MR with both the inocula and methods.

6. PANTNAGAR

In nodal cotton swabmethod, all the 28 genotypes showed R reactions for both pathotypes. In plug method, 1 genotype was found R, 19 MR and 7 MS and 1 S for CF08 pathotype whereas 2 genotypes were found R, 17 MR and 8 MS and 1 S for CF09 pathotype.

NORTH CENTRAL ZONE (Table 3)

1. PUSA

By plug method of inoculation, three genotypes CoP14437, CoP14438 and CoP 06436 were found R against CF08 isolate, fourteen genotypes CoP 14437, CoSe 14451, CoSe 14453, CoSe 01421, CoLk 94184, CoLk 14209, CoLk 14210, CoP 14438, CoP 14439, CoSe 14452, CoSe 14456, CoP 9301, BO 91 and CoP 06436 showed MR reaction against the CF07 isolate whereas, sixteen genotypes, CoLk 14206, CoLk 14207, CoP 14436, CoSe 14451, CoSe 14453, CoSe 14454, CoSe 01421, CoLk 14439, CoSe 14452, CoSe 14209, CoLk 14210, CoP 14439, CoSe 14452, CoSe 14455, CoP 9301 and BO 91 showed MR reaction against the CF08 isolate. In case of cotton swab method, genotypes CoSe 14454, CoSe 95422 and CoBln 14502 showed S reaction against both the isolates, whereas, CoSe 14456 showed S reaction to isolate CF0, while, the remaining genotypes showed R reaction against both the tested isolates.

2. MOTIPUR

In IVT (Early) seven genotypes viz., CoBln 14501, CoLk 14206, CoLk 14207, CoP 14436, CoP 14437, CoSe 14451 and CoSe 14453 were rated as MR and one genotype, CoP 14437 was MS to both the pathotypes. CoSe 14454 was MR against CF07 and MS against CF08. In AVT (Early)-I Plant, CoSe 13452 was rated as R against both the pathotypes, CoSe 13451 was MR whereas, CoP 13437 was MS to both the pathotypes. In AVT (Early)-II Plant, two genotypes CoLk 12207 and CoSe 12451 were MR against CF07 and CF08. Genotype CoP 12436 was MR against CF07 and S to CF08. In IVT (Mid late) eight genotypes were R and CoSe 14456 wsa MR against CF07 and CF08, CoSe 14452 was rated as R against CF07 and MR against CF08. In AVT (Mid late)-II Plant, three genotypes namely CoLk 09204, CoLk 12209 and CoP 12438 were rated as MR and genotype CoSe 12453 was R against CF07 whereas MR against CF08.

3. SEORAHI

Plug method: In initial varietal trial (Early) seven genotypes were rated as MR and one genotype CoBln 14501 behaved as MS to CF07 and MR to CF08. In initial

varietal trial (Mid late) seven behaved as MR to CF07 and eight behaved as MR to CF08. Genotype CoBln 14502 was rated as S to CF07 and MR to CF08, whereas genotype CoP 14438 was found MS to both pathotypes. In advanced varietal trial (Early) one genotype CoSe 13452 behaved as MR to both pathotypes, while CoSe 13451 behaved as MR to CF08 and MS to CF07.Nodal Cotton Swab method: In initial Varietal Trial (Early) all were found R to both designated pathotypes. In initial Varietal Trial (Mid-late) 8 genotypes were rated as R, while genotype CoBln14502 was rated as S to CF07, while all genotype behaved as R to CF08. In advanced varietal trial (Early) all were rated as R to CF07, while 2 genotypes were rated as R to CF08 and genotype CoP 13437 was rated as S to CF08.

NORTH EAST ZONE (Table 3)

1. BURALIKSON

A total of twenty six entries including one check variety and five (5) standard varieties were evaluated against red rot by plug and cotton swab methods of inoculation using CF07 and CF08 pathotypes. IVT (E) clone CoP 14454 and IVT (ML) clone CoBln 14502 were rated as MR in plug method and R in cotton swab method to both the pathotypes. In AVT(E) plant I, CoSe 13451 showed R reaction to CF07 in plug method and MR to CF08, CoSe 13452 showed MR to both the isolates in plug method and R in cotton swab method, CoSe 13437 showed MR to CF07 and R to CF08 in plug method and S to CF07 and R to CF08 in cotton swab method. In AVT(E) plant II, among the six genotypes tested all are found to be MR to both the isolates in plug method and R to both the isolates in cotton swab method except the genotype CoP 11438 which was found to be S to CF08 in cotton swab method. In AVT (midlate) plant II CoSe 11453 showed R reaction to CF07 and MR to CF08 in plug method and R to both the isolates in cotton swab method, other varieties showed MR in plug method and R in cotton swab method.

EAST COAST ZONE (Table 4)

1. ANAKAPALLE

Thirty four genotypes were tested for their reaction to the pathotype CF06 by cotton swab and plug methods of inoculations. In the cotton swab method, out of 34 entries tested, five ckeckCo 419, CoC 671, Co 997, CoA 89085 and Co 6907 manifested top drying indicating their susceptibility whereas the entries reacted as Rto CF06. In plug method of inoculation, four entries CoC 15336, Co 13028 and CoC 13339showed R while 16 entries,Co 86249, Co 13023, Co 13029, Co 13031, CoA 12324, CoA 11326, CoA 13322, CoA 13323, CoA 14321, CoA 14323, CoA 92081, CoC 01061, CoC 15339, CoC 14337, PI 14337, CoV 13356 andCoV 15356, showed MR reaction.

2. CUDDALORE

Among the 27 clones screened for resistance to red rot by plug method of inoculation using CF06 pathotype twenty two clones *viz*., Co 13023, Co 13028, Co 13029, Co 13031, CoA 11326, CoA 13322, CoA 14321, CoA 14323, CoC 13336, CoC 13337, CoC 13339, CoC 14336, CoC 14337, CoC 15336, CoC 15337, CoC 15338, CoC 15339, CoC 15340, CoOr 13346,CoOr 15346, CoV 15356 andPI 14377 were found to MR. In nodal cotton swab method, twenty five clones *viz*. CoC 15336, CoC 15337, CoC 15338, CoV 15356, Co 13023, CoA 14321, CoC 14336, CoA 13322, CoA 13323, CoC 13336, CoC 13337, CoV 13356, CoC 15339, CoC 15340, CoOr 15346, Co 13028, Co 13029, Co 13031, CoA 14323, CoC 14337, PI 14377, CoA 11326, CoA 12324, CoC 13339, CoOr 13346 were found to be R by nodal cotton swab method.

PENINSULAR ZONE (Table 5)

1. NAVSARI

In Plug Method out of 62 entries, none of the entries exhibited R reaction. Twenty six entries viz., Co 14004, Co 14006, Co 14009, Co 14012, Co 14016, Co 14026, Co 14032, CoN 14071, CoN 14072, CoN 14073,CoN 14074, CoSnk 14102, CoSnk 14103, CoTl 14111 CoVC 14062 and MS 14082, (IVT), Co 12009,Co 12019 and Co 12024 (AVT-E I Plant), Co 11001,Co 11004,CoM 11081,CoM 11082 and CoM 11084 (AVT-E II Plant), Co 11007 and Co 11012 (AVT–ML II plant) showed MR reaction against red rot. Eleven entries *viz*., Co 13021, Co 14002, Co 14008, Co 14027, CoT 14367, MS 14081 and PI 14131 (IVT), Co 12008 and VSI 12121 (AVT-E I Plant), Co 11005 and CoM 11086 (AVT–ML II plant) exhibited MS reaction. In Cotton Swab Method out of 62 entries 53 exhibited R reaction, rest of three entries CoSnk 14101, Co 14023 and VSI 14122 showed S reaction.

2. THIRUVALLA

In IVT out of the 40 entries tested in plug method with CF06, 27 showed MR reaction, nine showed MS reaction, two showed S reaction and two showed HS reaction in plug method of inoculation. With the standard isolate CF12, twenty showed MR reaction, fourteen varieties showed MS reaction, four showed S reaction and showed HS reaction in plug method of inoculation. In Nodal cotton swab method of inoculation, all the entries except seven *viz*., CoTl 14112, CoVc 14061, PI 14131, PI 14132, VSI 14121, Co 86032, CoC 671showed R reaction to both CF06 and CF12. In AVT (I Plant)out of the eleven entries, three exhibited MR reaction, five exhibited MS reaction, two exhibited S reaction and one exhibited HS reaction against the standard isolate CF06 in plug method of inoculation. Out of the eleven entries tested against CF12, by plug method of inoculation, one showed MR reaction, five showed MS reaction, four showed S reaction and one showed HS reaction. In nodal cotton swab method

of inoculation, five entriesshowed R reaction to both CF06 and CF12 whereas all the other six showed S reaction.In AVT (II PLANT EARLY) out of the eight entries tested with the standard isolate CF06, MR reaction was recorded in four, MS reaction in three and HS reaction in one entry by plug method of inoculation. Against the isolate CF12, threerecordedMR reaction, four recorded MS reaction and one recorded HS reaction in plug method of inoculation.In Nodal cotton swab method of inoculation, except CoC 671 all entries showed R reaction to both the isolates. In AVT II Midlate, out of the eight entries tested against CF06, four recorded MR reaction, three recorded MS reaction and one recorded S reaction in plug method of inoculation. Against CF12, three entries recorded MR reaction, four recorded MS reaction and one recorded S reaction in plug method of inoculation.In Nodal cotton swab method of inoculation, except Co 86032 all entries showed R reaction to both the isolates.

3. COIMBATORE

Thirty seven entries of IVT were evaluated for red rot resistance by plug and nodal methods against CF06 and CF12 pathotypes. Since the disease development during the season was erratic the trial is being repeated.

SUMMARY

The entries showing R or MR to red rot by various methods of evaluation are listed below:

NORTH WEST ZONE (Table 1 and 2)		
LUCKNOW- plugand nodal cotton swab		
IVT (Early)	:	Co 14034, CoLk 14201, CoLk 14202, CoPant 14221, CoPant 14222, CoPb 14181 and CoPb 14182
IVT (Midlate)	:	Co 14035, Co 05011, CoH 14261, CoH 14262, CoLk 14203, CoLk 14204, CoLk 14205, CoPant 97222, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14232 and CoS 14233
AVT (Early)-I	:	Co 13034 and CoPb 13181
AVT (Early)-II	:	Co 12027 and CoLk 12203
AVT (Midlate)-I	:	Co 13035, CoH 13263, CoLk 13204, CoPant 13224 and CoPb 13182
AVT (Midlate)-II	:	Co 12029, CoH 12263, CoLk 12205, and CoS 12232
SHAHJAHANPUR–Plug&Nodal cotton swab method		
AVT (Early) Plant I	:	CoS 13231
AVT (Early) Plant II	:	Co 12027, CoLk 12203, CoPant 12221
AVT (Midlate) Plant I	:	Co 13035, CoPb 13182
AVT (Midlate) Plant II	:	Co 12029, CoS 12232
IVT (E)	:	CoLk 14201, CoLk 14202, CoPant 14222, CoPb 14182
IVT (Midlate)	:	Co 14035, CoH 14261, CoH 14262, CoLk 14203, CoLk 14204, CoPb 14184, CoPb 14185, CoS 14232
KAPURTHALA – Plug method& Nodal cotton swab		
AVT (Early) Plant I	:	CoS 13231
AVT (Early) Plant II	:	Co 12026 and Co 12027
AVT (Midlate) Plant I	:	CoPant 13224 and CoPb 13182
AVT (Midlate) Plant II	:	Co 12029, CoPant 12226 and CoPb 12211
IVT (Early)	:	CoLk 14201, CoLk 14202, CoPant 14222, CoPb 14181, CoPb 14182, CoPb 14211
IVT (Midlate)	:	Co 14035, CoH 14261, CoH 14262, CoLk 14203, CoLk 14204, CoLk 14205, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212 and CoS 14232
UCHANI – Plug &Nodal cotton swab method		
AVT (E) Plant I	:	Co 13034 and CoS13231
AVT (E) Plant II	:	CoPant 12221
AVT (Midlate) Plant I	:	Co 13035, CoH 13263 and CoPb 13182
AVT(Midlate) Plant II	:	Co 12029, CoH 12263 and CoPant 12226
IVT (Early)	:	Co 14034, Co Lk 14201, CoLk 14202, CoPant 14222 and CoPb14181
IVT (Midlate)	:	Co 14035,CoH 14261,CoH14062, CoLk 14204, CoPb 14183, CoPb 14184, CoS 14231,CoS 14232 and CoS 14233
KARNAL – Plug & nodal cotton swabmethod		
IVT (Early)	:	Co 14034, CoLk 14201, CoLk 14202, CoPant 14222, CoPb 14181, CoPb 14182

IVT (Midlate)	:	Co 14035, CoH 14261, CoH 14262, CoH 14263, CoH 14264, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14232
AVT (E) Plant I	:	Co 13034, CoS 13231
AVT (E) Plant II	:	Co 12026, Co 12027
AVT (Midlate) Plant I	:	Co 13035, CoPb 13182
AVT (Midlate) Plant II	:	Co 12029, CoPant 12226, CoS 12232
PANT NAGAR- Plug & nodal cotton swab method		
IVT (Early)	:	Co 14034, CoLk 14201
IVT (Midlate)	:	CoLk 14203, CoLk 14204, CoS 14232, CoS 14233
AVT (E) Plant I	:	CoS 13221
AVT (E) Plant II	:	Co 12026, CoLk 12203, CoPant 12221
AVT (Midlate) Plant I	:	CoH 13263, CoLk 13204, CoPb 13182
AVT (Midlate) Plant II	:	CoH 12263, CoLk 12205, CoPb 12211, CoS 12232
NORTH CENTRAL ZONE (Table 3)		
PUSA- Plug & Cotton swab method		
IVT (Early)	:	CoP14437, CoSe14451, CoSe14453, CoSe 01421, CoLk 94184
IVT (Midlate)	:	CoLk 14209, CoLk 14210, CoP 14438, CoP 14439, CoSe14452
MOTIPUR - Plug and cotton swab method		
IVT (Early)	:	CoBln 14501, CoLk 14206, CoLk 14207, CoP 14436, CoP 14437, CoSe 14451 and CoSe 14453
IVT (Mid late)	:	CoBln 14502, CoLk 14208, CoLk 14209, CoLk 14210, CoP 14438, CoP 14439, CoSe 14452, CoSe 14455 and CoSe 14456
AVT (Early) I Plant	:	CoSe 13451, CoSe 13452
AVT (Early) II Plant	:	CoLk 12207 and CoSe 12451
AVT (Mid late)-II Plant	:	CoLk 09204, CoLk 12209 and CoP 12438
SEORAHI – Plug and nodal cotton swab method		
IVT (Early)	:	CoLk 14206, CoLk 14207, CoP 14436, CoSe 14451, CoSe 14453, CoSe 14454
IVT (Mid late)	:	CoLk 14208, CoLk 14209, CoLk 14210, CoP 14439, CoSe 14452, CoSe 14455, CoSe 14456
AVT (Early) I Plant	:	CoSe 13452
NORTH EAST ZONE (Table 3)		
BURALIKSON – Plug & nodal cotton swab method		
IVT (Early)	:	CoP 14454
IVT (Midlate)	:	CoBln 14502
AVT (Early)- I Plant	:	CoSe 13451, CoSe 13452
AVT (Early)- II Plant	:	CoSe 12451, CoP 12436, CoLk12207, CoP 11436, CoP 11437
AVT (Midlate)- II Plant	:	CoLk 12209, CoLk 09204, CoP 11451, CoP 12438, CoSe 11453, CoSe 11454, CoSe 11455, BO 155
EAST COAST ZONE (Table 4)		
ANAKAPALLE		
IVT Early	:	CoC 15336, CoV 15356
IVT Midlate	:	CoC 15339
AVT (Early)- I Plant	:	Co 13023, CoA 14321
AVT I (Midlate)	:	Co 13028, Co 13029, Co 13031, CoA 14323, CoC 14337, PI 14337
AVT II (Early)	:	CoA 13322, CoA 13323, CoV 13356
AVT (Midlate)- II Plant	:	CoA 11326, CoA 12324, CoC 13339
CUDDALORE- Plug and nodal cotton swab method		
IVT (Early)	:	CoC 15336, CoC 15337, CoC 15338, CoV 15356
IVT (Midlate)	:	CoC 15339, CoC 15340, CoOr 15346
AVT- Early (I Plant)	:	Co 13023, CoA 14321, CoC 14336
AVT- Early (II Plant)	:	CoA 13322, CoC 13336, CoC 13337
AVT-Mid late (I Plant)	:	Co 13028, Co 13029, Co 13031, CoA 14323, CoC 14337, PI 14377

AVT-Mid late (II Plant)	:	CoA 11326, CoC 13339, CoOr 13346
PENINSULAR ZONE (Table 5)		
NAVSARI – Plug method		
IVT (Early)	:	Co 14004, Co 14006, Co 14009, Co 14012, Co 14016, Co 14026, Co 14032, CoN 14071, CoN 14072, CoN 14073, CoN 14074, CoSnk 14102, CoSnk 14103, CoSnk 14111, CoVc 14062, MS 14082
AVT (Early) Plant I	:	Co 12009, Co 12019, Co 12024
AVT (Early) Plant II	:	Co 11001, Co 11004, CoM 11081, CoM 11082, CoM 11084
AVT (Midlate) Plant II	:	Co 11007, Co 11012
THIRUVALLA – Plug & nodal cotton swab method		
IVT (Early)	:	Co 13021, Co 13022, Co 14003, Co 14004, Co 14006, Co 14008, Co 14009, Co 14012, Co 14016, Co 14023, Co 14026, Co 14027, Co 14030, Co 14031, Co 14032, CoN 14071, CoN 14073, CoN 14074, CoSnk 14102, CoSnk 14103, CoT 14366, CoT 14367, CoTl 14111, MS 14081, MS 14082, CoVC 14062 and CoSnk 05103
AVT (Early) Plant I	:	Co 12008, Co 12019, CoSnk 05103
AVT (Early) Plant II	:	Co 11004, CoM 11084, Co 85004, Co 94008
AVT (Midlate) Plant II	:	Co 11007, Co 11012, CoM 11086, Co 99004

PP 17B: EVALUATION OF ZONAL VARIETIES FOR SMUT

Objective : To gather information on the relative resistance of the entries to smut inoculation in zonal trials of the respective zones.

Locations

North West Zone : Lucknow, Kapurthala, Shahjahanapur, Pantnagar

North Central Zone : Pusa, Seorahi

East Coast Zone : Anakapalle, Cuddalore

Peninsular Zone :Coimbatore, Powarkheda, Thiruvalla, Padegaon, Navsari, Kolhapur, Sankeshwar and Pune

Year of Start : 1994-95 (continuous project)

Varieties: All the entries of early and midlate group under IVT and AVT of the respective zones. The seed material is to be obtained from the respective breeders of the centre.

Inoculum: *Sporisorium scitamineum* (Syn. *Ustilago scitaminea*) teliospores freshly collected from smut susceptible sugarcane varieties will serve as source of inoculum.

Storage: Freshly collected whips are air dried by keeping under shade and teliospores are collected in butter paper bags and are stored in desiccators under anhydrous calcium chloride. Spore viability is to be ensured before inoculation.

Three budded setts of the test clones/entries to be pre-soaked in smut teliospore suspension (spore load @ 10^6 spores ml^{-1}) for a period of 30 min along with the respective checks/standards for R and S categories and planted in 6m/20' rows. Field observations to be made from the time of whip emergence (around 45 days) at fortnightly intervals and the number of smut infected clumps to be recorded. Evaluation is based on the percentage of clumps infected (No. of affected clumps/total clumps 100). It is required to maintain at least 15 to 20 clumps in each genotype before arriving at the percentage infection.

The following grading was followed for calculating the disease reaction.

0 %	: Resistant (R)
0.1 to 10 %	: Moderately Resistant (MR)
10.1 to 20 %	: Moderately Susceptible (MS)
20.1 to 30 %	: Susceptible (S)
Above 30%	: Highly susceptible (HS)

RESULTS

NORTH WEST ZONE (Table 1 and 2)

1. LUCKNOW

Out of 41 genotypes tested, 15 genotypes viz.,Co 05011, Co 12026, Co 13034, Co 13035, CoH 14261, CoH 14262, CoH 13263, CoLk 12203, CoLk 14201, CoLk 14203, CoPant 14221, CoPb 13181, CoPant 13224, CoH 12263 and CoS 12232 were graded as R and nine genotypes viz.,Co 12027, CoLk 12205, CoLk 13204, CoPant 14222, CoPb 14182, CoPb 14184, CoPb 14185, CoPant 97222 and CoPb 13182 were rated as MR.

2. SHAHJAHANPUR

In AVT (Early) I Plant, all entries were found R except

CoS 13231 which was MR against smut. In AVT (Early) II Plant, three entries were observed R/MR and one CoPant 12221 behaved as MS. In AVT (Mid late) I Plant, all entries evaluated as R/MR except Co 13035 (MS). In AVT (Mid late) II Plant, out of six entries, five were screened as R/MR while CoLk 12205 rated as MS. All entries of IVT (Early) were evaluated as R or MR except CoPb 14182 (MS). Thirteen entries tested in IVT (Mid late) and results revealed that all entries were screened as R or MR except CoS 14232 against smut.

3. KAPURTHALA

Out of 38 genotypes, eight genotypes namely CoPant 14222, CoPb 14182, CoS 13231, Co 14261, CoLk 14204, CoPb 14184, CoPb 14212 and CoS 14232 were R and 15 genotypes were MR. Among remaining entries, 12 were MS and three entries were S. Five pathological standards *viz*., Co 740, Co 1158, Co 62175, NCO 310 and Katha were rated as highly susceptible (HS) and one standard (Co 7915) as MR.

4. PANTNAGAR

Out of 27 genotypes 6 genotypes were found R, 7 MR and remaining genotypes showed various degrees of susceptibility, i.e., 11 MS, 2 S and 1 HS.

NORTH CENTRAL ZONE (Table 3)

1. PUSA

It is observed that sixteen genotypes viz., CoLk 14206, CoLk 14207, CoP 14436, CoP 14437, CoSe 14451, CoSe 14453, CoLk 94184, CoLk 14208, CoLk 14209, CoLk 14210, CoP 14438, CoP 14439, CoSe 14452, CoSe 14455, CoP 9301 and CoP 06436 remained free from smut infection and they were graded as R, whereas, seven genotypes viz., CoSe 14454, CoBln 14501, CoSe 01421, CoSe 95422, CoSe 14456, CoBln 14502 and BO 91 showed MR reaction against smut.

2. MOTIPUR

Out of 27 genotypes tested, four genotypes viz., CoLk 14206, CoP 14437, CoP 13437 and CoSe 14451 were rated S, six genotypes viz., CoLk 12207, CoP 12436, CoSe 12451 CoLk 12209, CoP 12438 and CoSe 12453 were rated as MR and rest of 17 genotypes were rated as R against smut.

3. SEORAHI

In Initial Varietal Trial (Early) eight genotypes were evaluated out of which 5 genotypes were rated as R, one genotype as MR, one genotypes was as MS, while one genotype was rated as S. In Initial Varietal Trial (Mid late) nine genotypes were evaluated against smut disease and all were found R. In Advanced Varietal Trial (Early) 2 entries *viz.* CoSe 13451 and CoSe 13452 were rated as R, while genotype CoP 13437 was rated as MS.

EAST COAST ZONE (Table 4)

1. ANAKAPALLE

Out of 34 genotypes tested, none of the genotypes were found R to smut, while seven entries showed MR reaction (CoA 14321, Co13028, Co 13031, PI 14377, CoC 13337 and CoV 13356) and the remaining entries showed MS, S to HS reaction.

2. CUDDALORE

Among 26 clones screened 12 *viz*., Co 13028, Co 13031, CoA 12324, CoA 13322, CoC 13337, CoC 13339, CoC 14337, CoC 15336, CoC 15337, CoC 15338, CoC 15339, CoC 15340 andCoV 13356were MR. Ten clones *viz*., Co 13023, Co 13029, CoA 11326, CoA 14321, CoA 14323, CoC 13336, CoC 14336, PI 14377 and CoOr 13346 were MS, four clones *viz*., CoV 15356, CoA 13323, PI 15376 and PI 15377 were found S.

PENINSULAR ZONE (Table 5)

1. PADEGAON

Out of 56 genotypes screened in IVT (Early), 23 showed R reaction to smut. In AVT–Early (I Plant), out of 8 genotypes, 2 *viz.*, Co 12007, CoM 12085 showed R reaction. In AVT–Early (II Plant) out of 5 genotypes, 1 *viz.*, CoM11081 showed R reaction to smut, in AVT–Midlate (II Plant) out of 6 genotypes 4 genotypes *viz.*, Co 11005, Co 11012, Co 11019 and CoM11086 showed R reaction and two genotypes *viz.*, CoM11085 and Co 11007 showed MR reaction to smut.

2. SANKESHWAR

In IVT – Early & Midlate out of thirty seven entries tested, five *viz*., Co 14002, Co 14004, Co 14006, Co 14012 and Co 14030 were S to smut. In AVT – Early & Midlate PC-1 out of eight entries five *viz*., Co 12008, Co 12012, Co 12019, Co 12024 and CoM 12085 were identified as R. In AVT Early PC II out of five entries, Co 11001, Co 11004, CoM 11081, CoM 11082 and CoM 11084 were rated as R. In AVT Midlate PC II out of six entries four *viz*., Co 11007, Co11012, Co 11085 and CoM 11086 were identified as R.

3. POWERKHEDA

Report not received.

4. KOLHAPUR

Out of 56 entries screened in ZVT's, 15 genotypes in IVT shown R reaction, whereas 2 genotypes *viz.*, Co 14031 and Co 14032 showed HS reaction to smut. In AVT I Plant, 1 genotype *viz.*, Co 12024 showed R reaction whereas 5 genotypes showed MR and remaining 2 showed MS reaction. In AVT Early II plant, 1 genotype *viz.*, CoM 11082 showed R reaction whereas remaining 4 showed MR reaction, while 3 genotypes from AVT Midlate II

plant, *viz.*, Co 11012, Co 11019 and CoM 11086 showed R reaction.

5. PUNE

Out of 60 genotypes screenedagainst smut, 26 entries *viz.*, Co 10004, Co 10005, Co 10006, Co 10024, Co 10026, Co 10027, Co 10033, Co 11005, CoT 10366, Co 13008, Co 13013, Co 13016, CoM 11082, CoM 11085, CoM 11086, CoM 13082, CoN 13071, CoN 13072, CoN 13073, CoN 13074, CoSnk 13104, CoT 13366, CoT 10368 and MS 13081 were found R, 3 were found MR, 25 were found MS, 5 were found S and 1 genotype was found HS.

6. NAVSARI

Out of 56 entries evaluated for smut resistance, 20 entries viz., Co 14003, Co 14004, Co 14009, Co 14025, Co 14032, CoN 14071, CoN 14072, CoN 14073, CoN 14074, CoSnk 14101, CoT 14367, MS 14082 and VSI 14122 (IVT) exhibited R reaction, Co 12019 (AVT–E I plant), Co 11001 and CoM 11084 (AVT-E II Plant), Co 11005, Co 11019, CoM 11085 and CoM 11086(AVT–ML II plant) exhibited R reaction. Similarly ten entries viz., Co 13021, Co 14006, Co 14008, Co 14022, MS 14081, CoSnk 14103, CoVC 14062 and VSI 14121 (IVT), Co 12024 and CoM 12085 (AVT-E I Plant) showed MR reaction.

7. COIMBATORE

About 37 entries including two check varieties were evaluated for smut resistance, in that about 17 entries were identified as R/MR and six behaved as MS and the rest were S/HS to the disease.

SUMMARY

Entries showing R and MR against smut are as follows:

NORTH WEST ZONE (Table 1 and 2)		
LUCKNOW		
AVT (Early) Plant I	:	Co 13034, CoPb 13181
AVT (Early) Plant II	:	Co 12026, Co 12027, CoLk 12203
AVT (Midlate) Plant I	:	Co 13035, CoH 13263, CoLk 13204, CoPant 13224, CoPb 13182
AVT (Midlate) Plant II	:	CoH 12263, CoLk 12205, CoS 12232
IVT (Early)	:	CoLk 14201, CoPant 14221, CoPant 14222, CoPb 14181
IVT (Midlate)	:	Co 05011, CoH 14261, CoH 14262, CoLk 14203, CoPb 14184, CoPb 14185, CoPant 97222
KAPURTHALA		
AVT (Early) Plant I	:	CoPb 13181, CoS 13231
AVT (Early) Plant II	:	Co 12026
AVT (Midlate) Plant I	:	CoH 13263, CoPant 13224
IVT (Early)	:	Co 14034, CoLk 14201, CoLk 14202, CoPant 14222, CoPb 14182, CoPb 14211
IVT (Midlate)	:	Co 14035, CoH 14261, CoH 14262, CoLk 14204, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14232, CoS 14233
SHAJAHANPUR		
AVT (Early) Plant I	:	Co 13034, CoPb 13181, CoS 13231
AVT (Early) Plant II	:	Co 12026, Co 12027, CoLk 12203
AVT (Midlate) Plant I	:	CoH 13263, CoPant 13224, CoPb 13182, CoLk 13204
AVT (Midlate) Plant II	:	Co 12029, CoH 12263, CoPant 12226, CoPb 12211, CoS 12232
IVT (Early)	:	Co14034, CoLk 14201, CoLk 14202, CoPant 14222, CoPb 14181, CoPb 14211
IVT (Midlate)	:	Co 14035, CoH 14261, CoH 14262, CoLk 14203, CoLk 14204, CoLk 14205, CoPb14183, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14231, CoS 14233
PANT NAGAR		
AVT (Early) Plant I	:	CoPb 13181, CoS 13231
AVT (Early) Plant II	:	CoLk 12203
AVT (Midlate) Plant I	:	CoLk 13204, CoPant 13224, CoPb 13182
AVT (Midlate) Plant II	:	CoH 12263, CoPant 12226, CoS 12232
IVT (Early)	:	CoPb 14181, CoLk 14201
IVT (Midlate)	:	CoLk 14204, CoPb 14212

NORTH CENTRAL ZONE (Table 3)		
PUSA		
IVT (Early)	:	CoLk 14206, CoLk 14207, CoP 14436, CoP 14437, CoSe 14451, CoSe 14453, CoSe 14454, CoBln 14501, CoSe 01421, CoLk 94184
IVT (Mid late)	:	CoLk 14208, CoLk 14209, CoLk 14210, CoP 14438, CoP 14439, CoSe 14452, CoSe 14455, CoSe 14456, CoBln 14502, CoP 06436
SEORAHI		
IVT (Early)	:	CoBln 14501, CoLk 14207, CoP 14436, CoSe 14451, CoSe 14453, CoSe 14454
IVT (Mid late)	:	CoBln 14502, CoLk 14208, CoLk 14209, CoLk 14210, CoP 14438, CoP 14439, CoSe 14452, CoSe 14455, CoSe 14456
AVT (Early) I Plant	:	CoSe 13451, CoSe 13452
EAST COAST ZONE (Table 4)		
ANAKAPALLE		
IVT Early	:	Nil
IVT Midlate	:	Nil
AVT (Early) I Plant	:	Co 13023, CoA 14321
AVT- Early (II Plant)	:	CoC 13337, CoV 13356
AVT- Midlate I Plant	:	Co 13028, Co 13031, PI 14377
AVT- Midlate II Plant	:	Nil
CUDDALORE		
IVT (Early)	:	CoC 15336, CoC 15337, CoC 15338
IVT (Mid late)	:	CoC 15339, CoC 15340
AVT (Early) I Plant	:	Nil
AVT- Early (II Plant)	:	CoC 13337, CoV 13356
AVT- Midlate I Plant	:	Co 13028, Co 13031, CoC 14337
AVT- Midlate II Plant	:	CoA 12324, CoC 13339
PENINSULAR ZONE (Table 5)		
PADEGAON		
IVT (Early)	:	Co 13021, Co 13022, Co 14003, Co 14004, Co 14006, Co 14008, Co 14009, Co 14012, Co 14016, Co 14026, Co 14027, Co 14030, Co 14101, CoN 14071, CoN 14072, CoN 14073, CoN 14074, CoSnk 14102, CoSnk 14103, CoT 14366, CoT 14111, CoT 14112, CoVc 14061, CoVc 14062, MS 14081, MS 14082, PI 14131, PI 14132, VSI 14121, VSI 14122
AVT(Early) Plant I	:	Co 12007, Co 12009, Co 12012, Co 12019, CoM 12085, VSI 12121
AVT(Early) Plant II	:	Co 11001, CoM 11081, CoM 11084
AVT (Midlate) II Plant	:	Co 11005, Co 11007, Co 11012, Co 11019, CoM 11085, CoM 11086
KOLHAPUR		
IVT (Early)	:	Co 13021, Co 13022, Co 14003, Co 14004, Co 14006, Co 14008, Co 14009, Co 14012, Co 14016, Co 14026, Co 14027, Co 14030, CoN 14071, CoN 14072, CoN 14073, CoN 14074, CoSnk 14101, CoSnk 14102, CoSnk 14103, CoT 14111, CoT 14112, CoT 14367, CoVC 14061, MS 14081, MS 14082, PI 14131, PI 14132, VSI 14121, VSI 14122
AVT (Early) Plant I	:	Co12007, Co 12012, Co 12019, Co12024, CoM 12085, VSI 12121
AVT (Early) Plant II	:	Co 11001, Co 11004, CoM 11081, CoM 11082, CoM 11084
AVT (Midlate) II Plant	:	Co 11005, Co 11007, Co 11012, Co 11019, CoM 11085, CoM 11086
SANKESWHAR		
IVT (Early)	:	Co 14003, Co 14008, Co 14016, Co 14022, Co 14025, Co 14026, Co 14027, Co 14031, Co 14032, Co 14074, CoN 14071, CoN 14073, CoSnk 14101, CoSnk 14103, CoT 14112, CoT 14366, CoVc 14061, MS 14081, PI 14131, PI 14132, VSI 14121
AVT (Early) Plant I	:	Co 12008, Co 12012, Co 12019, Co 12024, CoM 12085
AVT (Early) Plant II	:	Co 11001, Co 11004, CoM 11081, CoM 11082, CoM 11084
AVT (Midlate) Plant II	:	Co 11007, Co 11012, Co 11085, CoM 11086
PUNE		
IVT (Early)	:	CoN 13071, CoN 13072, CoSnk13101, MS13081
AVT (Early) I Plant	:	CoM 11082

AVT (Early) II Plant	:	Co 10004, Co 10005, Co 10006, Co 10024, Co 10026, Co 10027, CoT 10366
AVT (Midlate)	:	Co 13008, Co 13013, Co 13016, CoM 13082, CoN 13073, CoN 13074, CoSnk 13104, CoT 13366, PI 13131
AVT Midlate I Plant	:	Co 11005, CoM 11085, CoM 11086
AVT Midlate II Plant	:	Co 09009, Co 10015, Co 10017, Co 10033, CoT 10368
NAVSARI		
IVT(Early)	:	Co 13021, Co 14003, Co 14004, Co 14006, Co 14008, Co 14009, Co 14022, Co 14025, Co 14032, CoN 14071, CoN 14072, CoN 14073, CoN 14074, CoSnk 14101, CoSnk 14103, CoT 14367, VSI 14122, MS 14081, CoVC 14062, MS 14082, VSI 14121
AVT(Early) Plant I	:	Co 12019, Co 12024, CoM 12085
AVT(Early) Plant II	:	Co 11001, CoM 11084
AVT (Midlate) Plant II	:	Co 11005, Co 11019, CoM 11085, CoM 11086
COIMBATORE		
	:	Co 14002, Co 14003, Co 14006, Co 14009, Co 14022, Co 14025, Co 14026, Co 14030, Co 14032, CoN 14071, CoN 14072, CoN 14073, CoSnk 14102, CoSnk 14103, CoT 14367, MS 14082, VSI 14121

PP 17C: EVALUATION OF ZONAL VARIETIES FOR WILT

Location :Lucknow, Kapurthala, Pusa, Motipur, Anakapalle, Navsari

Year of Start :2000-2001

Varieties :Entries of AVT of the respective zones for the year

Plot size and Planting: Two rows of 5 m length planted under wilt sick soils

Standards : Any wilt susceptible and resistant variety of the zone.

Observations : 1. Germination count at 45 days of planting

2. Appearance of wilt symptoms on the standing canes (on clumps)

3. At the end of 10 months, 10 clumps are to be uprooted with roots. All canes from the clumps will be split open longitudinally and the wilt severity index scored on a 0-4 scale.

Evaluation : 0-4 Scale of wilt severity index

Grade	Symptoms
0	Healthy canes and roots with no external or internal symptoms of wilt.
1	No wilting or drying of leaves, no stunting or shrinking of the stalk or rind, slight pith formation with yellow discolouration of the internal tissues in one or two lower internodes only. No cavity formation or fungal growth seen. Apparently normal and healthy roots.
2	Mild yellowing of top leaves and drying of lower leaves, mild stunting and shrinking of the stalk and rind. Yellowish discolouration of the internal tissues extend to three or four bottom internodes. Slight cavity formation of the pith, no fungal growth seen, slightly discoloured roots.
3	Mild yellowing of top leaves and drying of lower leaves, mild stunting and shrinking of the stalk and rind. Light brown discolouration of the internal tissues throughout the entire length of the cane except the top. Severe pith and cavity formation. Sparse fungal growth observed in the pith cavities.
4	Complete yellowing and drying of the leaves, marked stunting, shrinking and drying of the stalk and rind, dark brown discolouration of the internal tissues extending throughout the entire length of the cane. Large pith cavities with profuse over growth of the associated fungi. Most of the roots necrotic with dark discoloration and dislodge easily from the stalks. Roots mildly discoloured and slightly necrotic.

The mean wilt severity index is worked out based on the number of canes sampled.

Mean wilt severity index = Sum of wilt indices of individual stalks/Number of stalks sampled

Note: Varieties were screened for wilt resistance in wilt sick plot.

RESULTS

1. LUCKNOW

Out of 41 genotypes, 12 genotypes viz., Co 05011, Co 14034, CoLk 13204, CoLk 14205, CoPant 14222, CoPb

13182, CoPb 14182, CoPb 14185, CoPb 14211, CoPb 14212, CoS 14231 and CoS 14232 exhibited natural incidence of wilt.

2. KAPURTHALA

Out of 38 entries, 27 viz., Co 12026, Co 12027, Co 12029, Co 13035, Co 14261, Co 14262, CoPant 14222, CoPant 12221, CoH 12263, CoLk 12205, CoLk 13204, CoLk 14201, CoLk 14202, CoLk 14203, CoLk 14204, CoLk 14205, CoPb 12211, CoPb 13181, CoPb 13182, CoPb 14182, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212, CoS 13231, CoS 14232 and CoS 14233 behaved as R. The six entries viz., Co 13034, Co 14035, CoPant 12226, CoPant 13224, CoPb 14181 and CoS 12232 behaved as MR and five entries viz., Co 14034, CoH 13263, CoLk 12203, CoPb 14211, and CoS 14231 as MS. Two standards viz., Co 07717 and Co 89003 behaved as HS.

3. PUSA

Among twenty three evaluated genotypes, eight genotypes (CoLk14206, CoLk14209, CoP 06436, CoP 9301, CoP14437, CoSe 01421, CoSe14453 and CoSe14455) were found free from wilt disease and they were graded as R, whereas, eleven genotypes (BO 91, CoBln 14501, CoLk 94184, CoLk14207, CoLk14210, CoP14436, CoP14438, CoP14439, CoSe14451, CoSe14452 and CoSe14456) were graded as MR and two genotypes (CoBln 14502 and CoLk 14208) were found MS, while, two genotypes (CoSe 14454 and CoSe 95422) showed S reaction to wilt disease.

4. MOTIPUR

Out of 27 genotypes tested, natural incidence of wilt was observed in eight genotypes viz., CoLk 14207, CoLk 14209, CoLk 14210**,** CoP 14436, CoSe 12451, CoSe 13451, CoSe 14451 and CoSe 14456. Other 19 entries viz., CoBln 14501, CoBln 14502 , CoLk 12207, CoLk 09204, CoLk 12209, CoLk 14206, CoLk 14208**,** CoP 12436, CoP 12438, CoP 13437, CoP 14437, CoP 14438**,** CoP 14439**,** CoSe 14454, CoSe 12453, CoSe 13452, CoSe 14452**,** CoSe 14453 and CoSe14455 were free from wilt.

5. ANAKAPALLE

Out of 34 varieties / genotypes tested, eight entries (Co 13031, Co Or 13346, CoA 14321, CoA 12324, CoC 01061, CoC 13339, CoV 15356 and PI 15377) showed R reaction while eleven entries (85 A 261, Co 13023, Co 13028, Co 7706, Co 86249, CoA 13322, CoA 14323, CoC 14337, CoC 15339, PI 14377 and PI 15376) reacted as MR. The remaining entries viz., Co 13029, Co 419, Co 6907, Co 7219, Co 997, CoA 11326, CoA 13323, CoA 92081, CoC 13336, CoC 13337, CoC 14336, CoC 15336, CoC 15340, CoC 671 and CoV 13356 showed S to HS reaction.

6. NAVSARI

Out of 25 varieties, 15 entries viz., Co 11001, Co 11004, Co 11005, Co 11007, Co 11012, Co 12009, Co 12024, Co 94008, Co 99004, CoM 11081, CoM 11082, CoM 11084, CoM 11086, CoSnk 05103 and VSI 12121 showed moderately resistant reaction. six viz., Co 12007, Co 12019, Co 85004, Co 86032, CoM 11085 and CoM 12085 exhibited moderately susceptible reaction to wilt.

SUMMARY

The entries showing R or MR to wilt are listed below

NORTH WESTERN ZONE (Table 1 and 2)		
LUCKNOW		
IVT (Early)	:	Co 14034, CoLk 14201, CoLk 14202, CoPant 14221 and CoPb 14181
AVT (Early) Plant - I	:	Co 13034, CoPb 13181 and CoS 13231
AVT (Early) Plant - II	:	Co 12026, Co 12027, CoLk 12203 and CoPant 12221
IVT (Mid Late)	:	Co 14035, CoH 14261, CoH 14262, CoLk 14203, CoLk 14204, CoPb 14183, CoPb 14184, CoS 14233 and CoPant 97222
AVT (Midlate) Plant - I	:	Co 13035, CoH 13263 and CoPant 13224
AVT (Midlate) Plant - II	:	Co 12029, CoH 12263, CoLk 12205, CoPant 12226, CoPb 12211 and CoS 12232
KAPURTHALA		
IVT (Early)	:	CoLk 14201, CoLk 14202, CoPant 14222, CoPb 14181 and CoPb 14182
AVT (Early) Plant - I	:	Co 13034, CoPb 13181 and CoS 13231
AVT (Early) Plant - II	:	Co 12026, Co 12027 and CoPant 12221
IVT (Mid Late)	:	Co 14035, Co 14261, Co 14262, CoLk 14203, CoLk 14204, CoLk 14205, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14232 and CoS 14233
AVT (Mid Late) Plant - I	:	Co 13035, CoPant 13224, CoPb 13182 and CoLk 13204
AVT (Midlate) Plant - II	:	Co 12029, CoH 12263, CoLk 12205, CoPant 12226, CoPb 12211 and CoS 12232
NORTH CENTRAL ZONE (Table 3)		
PUSA		

IVT (Early)	:	CoLk 14206, CoLk 14207, CoP 14436, CoP 14437, CoSe 14451, CoSe 14453, CoBln 14501, CoSe 01421 and CoLk 94184
IVT (Mid Late)	:	CoLk 14208, CoLk 14209, CoLk 14210, CoP 14438, CoP 14439, CoSe 14452, CoSe 14455, CoSe 14456, BO 91 and CoP 06436
MOTIPUR		
IVT (Early)	:	CoBln 14501, CoLk 14206, CoP 14437, CoSe 14453 and CoSe 14454
AVT (Early) Plant - I	:	CoP 13437 and CoSe 13452
AVT (Early) Plant - II	:	CoLk 12207 and CoP 12436
IVT (Mid Late)	:	CoBln 14502 , CoLk 14208, CoP 14438, CoP 14439, CoSe 14452 and CoSe 14455
AVT (Midlate) Plant- II	:	CoLk 09204, CoLk 12209, CoP 12438, CoSe 12453
EAST COAST ZONE (Table 4)		
ANAKAPALLE	:	
IVT (Early)	:	CoV 15356
AVT (Early) Plant - I	:	Co 13023 and CoA 14321
AVT (Early) Plant - II	:	CoA 13322
IVT (Mid Late)	:	CoC 15339, PI 15376 and PI 15377
AVT (Mid Late) Plant - I	:	Co 13028, Co 13031, CoA 14323, CoC 14337 and PI 14377
AVT (Mid Late) Plant - II	:	CoA 12324, CoC 13339 and Co Or 13346
PENINSULAR ZONE (Table 5)		
NAVSARI		
AVT (Early) Plant - I	:	Co 12007, Co 12009, Co 12024 and VSI 12121
AVT (Early) Plant - II	:	Co 11001, Co 11004, CoM 11081, CoM 11082 and CoM 11084
AVT (Midlate) Plant - II	:	Co 11005, Co 11007, Co 11012 and CoM 11086

PP 17D: YELLOW LEAF DISEASE (YLD)

YL disease symptoms of mid rib yellowing are expressed during 6-8 months crop stage. If disease severity increases, the yellowing spreads to laminar region and later there will be drying of affected mid rib and adjoining laminar tissue from leaf tip downwards along the mid rib. Another important symptom would be bunching of leaves in the crown. Highly susceptible variety will exhibit severe foliage drying during maturity stage. In place of yellow discoloration, purple or pinkish purple discoloration may also be seen on the mid rib and lamina. Canes of the affected plant do not dry. To assess YL severity, the following disease severity grades are to be given during maturity stages of the crop (3 observations by 8th, 10th and 12th months). Each time, minimum of 25 canes (free from other biotic stresses) are to be scored.

YL severity grades

(The colour photographs of YL symptoms displaying severity grades are available in the soft copy of the technical programme).

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 YL
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

Mean of the severity grades to be computed and the following YL severity scale is to be used to assign disease reaction of the variety.

YL severity scale

Disease grade Score	Description 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

1. LUCKNOW

Natural incidence of Yellow leaf disease (YL) was observed in four genotypes viz., Co 13035, CoPb 14212, CoPb 14182 and CoPb 14185.

2. SHAHJAHANPUR

Thirty eight entries of the six trials were screened against the incidence of Yellow leaf disease (YL). In AVT (Early) I and II Plant, all entries were behaved as resistant against YL. In AVT (Mid late) I Plant, out of five entries, three were rated as R while two (Co 13035, CoPant 13224) were rated as MR. In AVT (Mid late) II Plant, all the entries were rated as R except CoPant 12226 (MR). In IVT (Early), out of seven entries, five were rated as R and two (CoPant 14222, CoPb 14211) were MR. In IVT (Mid late), ten entries were evaluated as R whereas three entries namely CoH 14261, CoH 14262 and CoS 14233 were rated as MR against YL.

3. KAPURTHALA

No Yellow leaf (YL) symptoms were observed at Kapurthala during 2017-18 crop season.

4. UCHANI

One entry CoS 13231 showed MR reaction and two entries viz., CoPb 13181 and Co 13034 showed MS and S reaction respectively against YL in AVT (early) Plant-1. In AVT (early) Plant II, all the four genotypes viz. Co 12026, Co 12027, CoLk 12203 and CoPant 12221 were found moderately susceptible against YL. In AVT (Midlate) Plant-1, entries CoH 13263 showed R reaction and two entries Co 13035 and CoPant 13224 were MS and S against YL. The entry CoH 12263 from AVT (Mid late) –II showed resistant reaction against YL and other four entries viz., Co 12029, CoLk 12205, CoPant 12226, CoPb 12211 and CoS 12232 were found moderately susceptible and CoS 12232 showed susceptible reaction to YL. In IVT (early), only CoPb 14181 was found moderately resistant against YL and other five entries viz., Co 14034, Co Lk 14201, CoLk 14202, CoLk 14204 and CoPb 14211 showed moderately S reaction and CoPant 14222 showed S reaction to YL. Nine entries from IVT (midlate) viz., CoH 14262, CoLk 14203, CoLk 14205, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14231 and CoS 14233 showed MR reaction against YL. Two entries Co 14035 and CoH 14261 exhibited moderately susceptible reaction and two entries CoS 14204 and CoS 14232 showed susceptible reaction against YL.

5. PANTNAGAR

Out of 28 genotypes, 20 were found resistant, 6 moderately resistant and 2 moderately susceptible. No material was found susceptible or highly susceptible.

6. PUSA

Yellow leaf disease symptom was observed on variety CoV 92102. The symptoms were also noticed in the farmers' fields on unknown varieties during survey and in Chamua village it was observed in traces under Harinagar sugar factory area in Co 0238.

7. MOTIPUR

Natural incidence of Yellow leaf disease (YL) was observed in ten genotypes viz., CoBln 14501, CoLk 14208, CoLk 14210, CoLk 12209, CoP 14436, CoP 14437, CoSe 14451, CoSe 13451, CoP 12436 and CoP 12438.

8. SEORAHI

Out of Eight IVT (Early) genotypes evaluated, five genotypes were resistant and three genotypes moderately susceptible to YL. Except one genotype CoP 13438, all other eight Initial Varietal Trial (Mid-late) genotypes exhibited resistance to YL. In Advanced Varietal Trial (Early) all three genotypes *viz.* CoP 13437, CoSe 13451 and CoSe 13452 showed resistant to YL.

9. ANAKAPALLE

Out of 34 genotypes screened, YL incidence was less recorded at mean YL severity Index of 0.0 - 1.0 in 85 A 261, Co 13023, Co 13028, Co 13029, Co 13031, Co 419, Co 7219, Co 7706, Co Or 13346, CoA 14321, CoA 11326, CoA 12324, CoA 14323, CoC 13336, CoC 14336, CoC 14337, CoC 15336, CoV 13356, CoV 15356, PI 14377, PI 15376 and PI 15377. YL severity index of 1.0 to 2.0 was observed in the genotypes, Co 6907, Co 997, CoC 13339 and CoC 671. Mean YL severity index ranged from 2.3 to 4.0 in the genotypes Co 86249 (C), CoA 13322, CoA 13323 and CoC 15340.

10. NAVSARI

Out of 56 varieties of zonal trial evaluated to yellow leaf disease, 42 entries showed resistant reaction. Ten entries viz., CoT 14366, MS 14081, MS 14082, Co 13021, Co 13022, Co 14016, Co 14023 and Co 14030 (IVT), Co 12019 and CoM 12085 (AVT-E-I Plant) were found moderately resistant reaction. Four entries viz., Co 14027, Co 14031 CoSnk 14103 (IVT) and Co 12008 (AVT-E-I Plant) displayed susceptible reaction.

11. SANKESHWAR

All six entries Co 11005, Co 11007, Co 11012, Co 11019, Co 11085 and CoM 11086 exhibited R reaction to YL.

12. COIMBATORE

During the season, about 37 IVT entries and 19 AVT entries were monitored for the YL severity based on the 0-5 scale. Among the IVT and AVT entries, 36 were apparently free from the disease symptoms and probably R to the disease, however further observations are required. The disease severity in rest of the entries were in the category of MS to MR. None of the entries exhibited severity scores of more than 3 and only five of them exhibited severity grade of 3.

SUMMARY

The entries showing R or MR to YL are listed below

NORTH WEST ZONE (Table 1 and 2)		
LUCKNOW		
IVT (Early)	:	CoLk 14202, CoPant 14221, CoPant 14222, CoPb 14181 and CoPb 14211
AVT (Early) Plant - I	:	Co 13034, CoPb 13181 and CoS 13231
AVT (Early) Plant - II	:	Co 12026, Co 12027, CoLk 12203 and CoPant 12221
IVT (Mid Late)	:	Co 14035, CoH 14261, CoH 14262, CoLk 14203, CoLk 14204, CoLk 14205, CoPb 14183, CoPb 14184, CoS 14231, CoS 14232, CoS 14233, CoPant 97222 and Co 05011
AVT (Mid Late) Plant - I	:	CoH 13263, CoLk 13204, CoPant 13224 and CoPb 13182
AVT (Mid Late) Plant - II	:	Co 12029, CoH 12263, CoLk 12205, CoPant 12226, CoPb 12211 and CoS 12232
AVT (Mid Late) Plant - II	:	CoLk 09204 and CoSe 12453
UCHANI		
AVT (Early) Plant - I	:	CoH 13263
AVT (Early) Plant - II	:	CoH 12263
IVT (Early)	:	CoPb 14182
IVT (Mid Late)	:	CoH 14262, CoLk 14203, CoLk 14205, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14231 and CoS 14233
SHAHJAHANPUR		
IVT (Early)	:	Co 14034, CoLk 14201, CoLk 14202, CoPant 14222, CoPb 14181, CoPb 14182, CoPb 14211, Co 0238, CoJ 64 and Co 05009
IVT (Mid Late)	:	Co 14035, CoH 14261, CoH 14262, CoLk 14203, CoLk 14204, CoLk 14205, CoPb 14183, CoPb 14184, CoPb 14185, CoPb 14212, CoS 14231, CoS 14232, CoS 14233, CoS 767, CoS 8436 and CoPant 97222
PANTNAGAR		
IVT (Early)	:	CoLk 14201, CoPb 14182, CoPb 14181 and Co 14034
AVT (Early) Plant - I	:	CoS 13221, CoS 13034
AVT (Early) Plant - II	:	CoPant 12221, Co 12026 and CoLk 12203
IVT (Mid Late)	:	CoPb 14212, CoPb 14183, CoLk 14203, CoLk 14204, CoS 14233, CoPb 14184 and CoS 14232
AVT (Early) Plant - I	:	Co 13035, CoPb 13182, CoH 13263 and CoPant 13224
AVT (Early) Plant - II	:	CoPant 12226, CoS 12232, CoPb 12211, CoLk 12205, CoH 12263 and Co 12029
NORTH CENTRAL ZONE (Table 3)		
MOTIPUR		
IVT (Early)	:	CoLk 14206, CoLk 14207, CoSe 14453 and CoSe 14454
AVT (Early) Plant - I	:	CoP 13437 and CoSe 13452
AVT (Early) Plant - II	:	CoLk 12207 and CoSe 12451
IVT (Mid Late)	:	CoBln 14502, CoLk 14209, CoP 14438, CoP 14439, CoSe 14452, CoSe 14455 and CoSe 14456
SEORAHI		
IVT (Early)	:	CoBln 14501, CoLk 14206, CoLk 14207, CoP 14436 and CoP 14437
IVT (Mid Late)	:	CoBln 14502, CoLk 14208, CoLk 14209, CoLk 14210, CoP 14439, CoSe 14452, CoSe 14455 and CoSe 14456
AVT (Early)	:	CoP 13437, CoSe 13451 and CoSe 13452
EAST COAST ZONE		
ANAKAPALLE		
IVT (Early)	:	CoC 15336 and CoV 15356

IVT (Mid Late)	:	PI 15376 and PI 15377
AVT (Early) Plant	:	Co 13023, CoA 14321 and CoC 14336
AVT I Mid late	:	Co 13028, Co 13029, Co 13031, CoA 14323, CoC 14337 and PI 14377
AVT II Early	:	CoC 13336 and CoV 13356
AVT (Mid Late) Plant - II	:	CoA 11326, CoA 12324, CoC 13339 and CoOr 13346
PENINSULAR ZONE (Table 4)		
NAVSARI		
IVT (Early)	:	Co 14002, Co 14003, Co 14004, Co 14006, CoN 14071, CoN 14072, CoSnk 14101, CoSnk 14102, CoT 14366, CoT 14367, MS 14081, MS 14082, Co 13021, Co 13022, Co 14008, Co 14009, Co 14012, Co 14016, Co 14022, Co 14023, Co 14025, Co 14026, Co 14030, Co 14032, CoN 14073, CoN 14074, CoTl 14111, CoTl 14112, CoVC 14061, CoVC 14062, PI 14131, PI 14132, VSI 14121 and VSI 14122
AVT (Early) Plant - I	:	Co 12007, Co 12009, Co 12012, Co 12019, Co 12024, CoM 12085 and VSI 12121
AVT (Early) Plant - II	:	Co 11001, Co 11004, CoM 11081, CoM 11082 and CoM 11084
AVT (Mid Late) Plant - II	:	Co 11005, Co 11007, Co 11012, Co 11019, CoM 11085 and CoM 11086

PP 22: SURVEY OF SUGARCANE DISEASES NATURALLY OCCURRING IN THE AREA ON IMPORTANT VARIETIES

Objectives : To gather information on the diseases naturally occurring in the area on varieties to compile all India status report yearly.

Location :Lucknow, Karnal (SBI), Uchani, Pantnagar, Shahjahanpur, Kapurthala, Pusa, Seorahi, Buralikson, Anakapalle, Cuddalore, Nayagarh, Coimbatore, Padegaon, Tiruvalla, Navsari, Pune, Sankeshwar, Kolhapur and Akola.

Year of Start : 1989-1990

Observations :Periodic observations in June, September and December in all locations to gather information on the %incidence of diseases on all varieties of the area (General survey).

RESULTS

NORTH WEST ZONE

1. LUCKNOW

During 2017-18 sugarcane crop season surveys were conducted in command areas of different sugar mills located around the district Lucknow, Uttar Pradesh. Incidence of red rot was found in sugarcane varieties namely, CoS 8436, CoSe 92423, CoLk 8102, Co 0238 and CoSe 95422. Variety Co 0238 was affected with red rot at several locations in the command areas of different sugar mills and the disease incidence varied from 3 to 20 % in the affected cane fields. In some fields of CoSe 95422, CoS 8436, and CoSe 92423 the incidence of red rot was up to 30%. Incidence of smut was observed at several locations mostly affecting the sugarcane varieties viz., CoSe 92423, CoS 88230, CoS 91269 and Co 0238 (1-5%). GSD was noticed in most of the fields (1-5 %) and higher incidence was noticed in CoS 91269 (10-20 %) and Co 0238 (5-10 %). The incidence of Pokkah boeng was higher in Co 0238. In some fields of Co 0238 Pokkah boeng incidence was more than 30%. Sporadic incidence of leaf scald was also noticed in Co 0238.

2. KARNAL

Surveys were carried out to observe natural incidences of diseases in sugar mill areas in the states of Haryana, Uttar Pradesh and Bihar. Red rot incidence was recorded up to 45% in variety CoS 8436 at Harinagar (Bihar) and mild incidence in some fields of variety Co 89003 in UP and Haryana. Severe incidence of smut was observed in variety CoH 160 at village Gagsina (Karnal) and mild incidence in the fields of variety Co 0238 under Karnal, Bhadson, Indri, Nilokheri, Assandh and Yamunangar and also in varieties Co 89003 in Karnal, Sonipat and Gohana area of Haryana. Similarly, trace infection of smut was noticed in variety BO 147 at Harinagar, Bihar and also in the test entries viz. CoLk 14201,CoLk 14203, CoLk 16201, CoLk 15203 and CoPb 16212 under different trials. By and large, PB was prevailing in most of the varieties cultivated in the surveyed areas, however, maximum incidence (up to 40%) was found in variety CoH 160 at village Barsalu, Karnal. Further, wilt incidence up to 40% and *Sugarcane bacilliform virus* by 30% was seen in variety CoH 160 (ratoon) at village Gagsina, Karnal and by 20% in varieties CoLk 15203 and CoLk 15204. Mild incidence of GSD was recorded in ratoon of variety Co 0238 at two fields of UP.

3. UCHANI

Survey was conducted in various mill zones areas in Haryana during pre and post monsoon seasons during 2017-18. Red rot was observed on plant and ratoon crop of varieties like Co 89003, CoS 8436 and CoJ 85 in sugar mill zone areas of Shahabad, Yamunanagar, Karnal, Kaithal, Asandh ,Panipat, Rohtak and Badshu areas ranging from 2 to 20 % . Top rot was observed on varieties CoH 119, CoJ 85, CoS 8436 and Co 0238 in Shahabad, Yamunanagar, Kaithal, Badshu and Karnal areas ranging 2 to 45 %. Wilt was noticed in Co 89003, Co 05011,CoS 8436, CoH 119 in Panipat, Karnal and Yamunanagar areas ranging from 5 to 20%. Wilt in association with root borer and in association with red rot was also observed in Panipat and Karnal areas in Co 89003. Severe incidence of smut ranging from 5-80 percent was observed this year in Co 0238 in plant and ratoon crops and even up to 100 per cent in some villages of Shahabad areas. Smut also noticed 5-45 percent in Co 0238, Co 89003 and CoH 119, CoH 160, Co 0118 and Co 05011 in Yamunanagar, Gohana, Shahabad, Badshu, Rohtak, Kaithal and Meham sugar mill areas. Pokkha boeng was observed on varieties CoS 8436, Co 0238, CoH 119, CoJ 85, Co 89003 Co 0118, CoH 160, CoJ 85 Co 05011 in Shahabad, Yamunanagar, Panipat, Jind, Sonipat, Kaithal, Panipat, Asandh, Gohana and Karnal sugar mill zone areas ranging from 2-30 %. Yellow leaf disease (YLD) was noticed in Traces-5 % on varieties viz., Co 0238, CoS 8436, CoH 119, Co 89003, CoH 119, CoH 160 and Co 05011 in Yamunanagar, Karnal, Asand, Jind, Rohtak, Shahabad, Kaithal, Panipat and Yamunanagar. Incidence of mosaic in traces was observed in CoJ 85, CoH 119 and CoS 8436 varieties in Yamunanagar, Shahabad, Karnal,Panipat and Kaithal in 6-10 months old crops. Incidence of brown spot ranging from 5-40 percent was noticed in plant and ratoon crops of Co 238, Co118 and CoH 160 varieties in Gumthalla and Yamunanagar sugar mill areas.

4. PANTNAGAR

There was no incidence of red rot except at one place in CoS 8436 in Bajpur and Kashipur area. Smut incidence upto 30% was observed at isolated places in Bajpur and Khatima in CoS 7240 and low incidence observed on CoPant 99214 and Co 0238 during October to January. Low incidence of wilt was observed in Bajpur area in Co 89003 and in Co 5011 and CoJ 85 in Luxar area and in CoSe 1434 in Kashipur area from September onwards. GSD in low incidence was seen on Co 0118, CoPant 3220, CoPk 5191, Co 0238, CoPant 05224, CoJ 85, CoSe 1434 and CoS 88230. Foliar diseases like ring spots and eye spots were observed from scanty to mild in almost all the varieties during August, but was very severe on CoPant 99214, CoJ 85 in Kashipur area. YLD was present in scanty on CoPant 3220, CoPant 84212, CoPant 5224 and as mild incidence on CoS 767 and CoPant 90223 from November onwards.All popular cultivars of the area were found infected with PB and was most severe on Co 0238 (upto 50%) in Kanchanpuri, Khatima area but the varieties Co 0239 and CoPant 03220 were found least affected.

5. SHAHJAHANPUR

Incidence of red rot varied from one to 48 per cent on variety Co 0238 in various sugar factory zones of central UP. The variety Co 0238 was affected by red rot with the incidence of 1-2 per cent, 5 per cent, 15-42 per cent at Meerganj (Bareilly), Khambharkeda (Lakhmpur Kheri) and Hargaon factory zones, respectively. Similarly, it was also observed on Co 0238 from Palia (30%), Rosa (3-15%) and Gola (48%) factory zones. It was also recorded on varieties CoS 8436 and CoS 97264 with incidence up to 30 per cent and 2 per cent, respectively from Rosa factory zones. The incidence of smut varied from 0.5 to 30 per cent on Co 0238 at Nigohi (Shahjahanpur), Gola, Hargaon (Sitapur), Khambharkeda and Palia factory zones. Maximum incidence up to 50 per cent of this disease was reported on CoS 07250 and CoSe 01434 from Rosa (Shahjahanpur) factory zones. The incidence of wilt varied from 1 to 12 per cent on variety Co 0238 from Shahjahanpur and Lakhmpur Kheri districts. It was also noticed on Co 05011 and CoS 8432 with incidence of 5 and 2 per cent, from Sitapur and Lakhimpur Kheri, respectively. Grassy shoot disease was observed on various popular varieties ranging traces to 15 per cent at Shahjahanpur and Lakhmpur Kheri districts. The incidence of PB varied from traces to 33.6 per cent on Co 0238 from various factory areas. Knife cut stage of PB was recorded on Co 0238 and CoS 08279 at Rosa, Gola, Gularia and Ajabapur sugar factories zones. The varieties viz., CoS 08276, CoLk 94184, Co 98014 and CoS 08272 were also affected by PB. Maximum incidence of YLD was noticed up to 60 per cent on Co 05011 at Shahjahanpur farm. It was also observed on Co 0238 and CoS 8432 and its incidence varied from 2 to 20 per cent. Sugarcane mosaic, stinking rot, leaf binding diseases were also noticed at various sugar factories zones of central UP.

6. KAPURTHALA

The disease surveys on sugarcane crop were conducted in 9 Cooperative sugar mills (*viz*., Bhogpur, Budhewal, Batala, Gurdaspur, Nawanshahr, Ajnala, Morinda, Nakodar and Fazilka) and 7 private mills (*viz*., Mukerian, Dasuya, Kiriafgana, Buttar sevian, Phagwara, Dhuri and Amloh) areas during May-June, September and November. Red rot was observed with an incidence from traces to 12.0 per cent on varieties Co 89003, CoJ 64 and CoJ 85 and CoPb 91 in Ajnala, Amloh, Bhogpur, Bhudewal, Dhuri, Gurdaspur, Nakodar, Nawashahr and Phagwara sugar mills area. Wilt incidence of traces to 8.0 per cent was observed on Co 89003 and CoS 8436 in Amloh, Budhewal, Dhuri, Nawanshahr, and Fazilka

mills area. Varieties Co 0238 and Co 89003 were found infected with smut from traces to 10.0 per cent in Ajnala, Gurdaspur, Dasuya, Dhuri, Kiriafgana, Batala, Mukerian, Nawashahr, Nakodar and Phagwara mills area. Pokkah boeng disease was observed on variety Co 0238 (traces to 15%) in Ajnala, Batala, Bhogpur, Dasuya, Mukerian, Gurdaspur and Kiriafgana sugarmills area. Red stripe/top rot disease was observed in traces on CoJ 85 in Amloh, Bhogpur, Dhuri, Morinda and Nawanshahr sugar mills area. Grassy shoot disease (GSD) was observed with an incidence of traces to 2.0 per cent on Co 0238 in Bhogpur, Butter Sevian, Dasuya, Gurdaspur, Kiriafgana and Mukerian sugar mills area.

NORTH CENTRAL ZONE

1. PUSA

Yellow leaf disease symptom was observed on CoV 92102, Co 0238 and many other unknown varieties in Chamua village under Harinagar sugar factory area.Red rot (5-20%) was observed on CoS 8436, CoSe 95422, Co 0235 and Co 0238 in Pusa, Mujhaulia and Areraj areas. Wilt incidence was noticed in all areas of Bihar ranging from 2-30% on Co 0233, BO 141, Co 0235, CoPant 97222, BO 110, Co 0118, CoLk 94184 and Co 0238. Varieties BO 154, BO 141 and Co 0238 were found affected with smut disease ranging from traces to 5%. Pokkah boeng disease was observed on CoS 8436, Co 0118 and Co 0238 ranged between 2-5%. Grassy shoot disease was found upto 2% in Co 0235 and CoSe 95422. Yellow leaf disease was noticed on Co 0238 and CoV 92102 in traces whereas the variety CoLk 94184 was affected with RSD upto 2%.

2. SEORAHI

The survey was conducted in various factory zones of eastern Uttar Pradesh in pre monsoon, monsoon and post monsoon period. The red rot (5-12%) was recorded in CoS 07250 in the Khadda and Pratappur sugar factory zone. The incidence of 15 and 16 % was found in varieties CoSe 92423 and CoS 8436 respectively in Dhadha sugar factory zone. It was also reported in varieties Co 0238 and CoJ 88 with 10 and 20 % incidence respectively from Ramkola sugar factory zone. Wilt incidence was also observed in varieties Co 0238 (4%), CoS 08279 (6%) and CoP 9301 (6%) in Seorahi sugar factory zone. Varieties Co 98014 and Co 0238 were found infected with 5 to 6 per cent wilt incidence in Ramkola whereas in variety CoS 91269 5% incidence was noticed in Pratappur areas. The incidence of smut varied from 1 to 5 per cent in various varieties such as CoS 8436, Co 0238, CoS 97261, CoS 91269, CoSe 01434, CoSe 98231, CoS 07250, CoS 767, CoS 08272, Co 98014, Co 05009 from Tulsipur, Uttaraulla, Akabarpur, Masaudha, Rojz Gaon, Sultanpur, Walterganj, Rudhauli, Kundurakhi sugar factory zone of eastern Uttar Pradesh. GSD was noticed with 1 to 6 per cent incidence in different varieties namely CoS 07250, CoS 13231, CoS 08272, CoS 08279, Co 0118, Co 05011, CoS 91269, CoS 97261, CoSe 98231, CoSe 01424, Co 0238, UP 05125, Co 98014, CoSe 92423, CoS 88230 and CoJ 88 from Akbarpur, Balarampur, Sathiyaon, Masaudha, Seorahi, Sultanpur, Ramkola, Rudhauli, Roza Gaon, Manakapur, Khadda, Kundurkhi, Tulsipur, Uttraula and Waltarganj sugar factory zones. The incidence of PB varied from 1 to 15 per cent in varieties Co 98014, CoS 08272, CoS 97261, CoSe 96436, UP 05125, CoS 91269, CoS 06279, CoS 07250, CoS 10239, CoSe 92423, CoSe 01434, CoS 08279, CoS 8436 and Co 0238 at Akabarpur, Masaudha, Seorahi, Ramkola, Babhanan, Sathiyaon, Pratapur, Roza Goan, Rudhaulli, Tulshipur, Mankapur, Khadha, Kundurkhi, Sultanpur, Uttraula and Walterganj sugar mill zones. Pineapple disease was noticed in variety CoP 9301 with 30 to 35 per cent incidence in Pratappur sugar factory zone. YLD incidence was recorded up to 5 -10 per cent in Co 0118 and UP 05125 from Ramkola sugar mill zone. Mosaic incidence was recorded up to 6 - 8 per cent in varieties CoS 08272 and CoPant 97222 in Seorahi sugar factory zone. Stinking rot was observed in variety CoS 08279 (10%) at Masaudha sugar factory zone and RSD was also noticed in CoSe 92423 and CoS 97261 at Seorahi sugar factory zone.

NORTH EAST ZONE

1. BURALIKSON

Sugarcane genotypes were found to be affected with red rot, wilt, YLD, PB and leaf spot. Incidence of red rot was found upto 7.69 % .Wilt was observed in CoBln 9104, CoBln 9103, Co 997, Co 740 upto 19.23 %. YLD was observed in the genotype CoBln 9104, CoBln 9103, Co 997, Co 740 upto 8.57%. Foliar disease like ring spot was observed upto 53.33% in Charingia area in CoBln 9104 in grand growth stage. Pokkah boeng was observed upto 11.42% in CoBln 9103 in grand growth stage followed by 8.20% in BO 155 at the tillering stage.

EAST COAST ZONE

1. ANAKAPALLE

Red rot incidence was observed in Co 86032, Co 62175, 81V 48 ranging 10-50% in ratooon crops in Chodavaram, Munagapaka and Atchutapuram mandals of Visakhapatnam district and in Sankili sugar factory area of Srikakulam district. Smut incidence was observed in almost all the areas surveyed in North Coastal districts of Andhra Pradesh. The disease incidence ranged from 5-35% in varieties, viz., CoA 92081 (87A 298), CoV 09356 (2003V 46), CoA 7602, Co 62175, 93A 297 and 2000A 240, cultivated in Visakhapatnam, Vizianagaram and Srikakulam districts of Andhra Pradesh. High incidence of YLD was observed in sugarcane growing regions of Visakhapatnam district compared to Vizianagaram and Srikakulam districts of

Andhra Pradesh. The incidence of 5-30 % YLD was found to be higher in areas where the ratoon crops of the varieties, CoV 09356 and CoA 92081 are being cultivated. Mosaic was also observed to the tune of 15-40 % in Kasimkota, Chodavaram and Munagapaka mandals of Visakahapatnam district on varieties such as CoA 92081, CoV 09356 and CoA 7602. Grassy shoot disease incidence ranging from 5-20% was observed in the varieties Co 7508, Co 86032, Co A 92081, Co V 09356, CoA 7602 and 2009A 107. Wilt incidence (5-15%) was also observed in CoA 92081 and Co 62175 in Chodavaram, Ravikamatham and Butchayyapeta mandals. High incidence and severity of top rot was observed in the variety 2000A-225 in Seethanagaram mandal of Vizianagaram district and Anakapalli mandal of Visakhapatnam district. Leaf scald (5%) was observed in NBV 1 in Yeleswaram mandal of East Godavari district. Marasmiellus sheath and shoot blight/ stem rot of sugarcane was observed (10 %) in the variety, 2006A 102 in Lakavaram village of Chodavaram mandal, Visakhapatnam district.

2. CUDDALORE

The survey conducted in Sugar Mill areas in Cuddalore, Villupuram, and Perambalur Districts of Tamil Nadu and Puducherry indicated 2 to 22% incidence of red rot in varieties *viz.*, CoC 24 and Co 91017. Smut was recorded in varieties CoC 22 and CoSi 6, TNAUSi 8 and the disease severity ranged between 2 and 16 %. Wilt was observed in Co 86032 and CoV 09356 (2 to 14 %) and YLD was noticed in Co 86032 (5 to 25 %), PI 1401 (5 to 10 %), PI 001110 (5 to 10 %) and CoV 09356 (5 to 15 %).

NAYAGARH

During the surveys, it was observed that the variety CoV 09356 was showing 40% YLD when the crop was 9 months old. Co 6907 was recorded 58% ring spot and 20% YLD incidence. CoA 92081 was observed with 80% ring spot incidence and 10% smut incidence. Smut was observed in PI 1110 and Co 86032. Mild infection of PB was observed on 87A 380 and Co 0239. Severe leaf fleck was observed in 8th month old crop of CoA 92081 in Shakti sugar factory area of Cuttack. 40% YLD infection was observed in CoV 09356. Red rot incidence (5-35%) was recorded in varieties *viz.*, Co 86032, Co 6907, CoOr 03151, CoOr 041512 and Co 86249. Ring spot and GSD were predominant and their incidence ranged from 10-40% in several areas. Pokkah boeng was observed in rainy days in 5-10% but plants recovered after the season. Mosaic is prevalent disease in the areas and incidence varies from 5% to 40%.

PENINSULAR ZONE

1. COIMBATORE

Detailed surveys for sugarcane diseases were conducted in Tamil Nadu state during the season. Red rot was noticed in the varieties CoC 24, PI 1110, PI 1401 and Co 06022 in different districts except in Western and Southern regions. Smut was observed in the varieties CoSi 6, PI 1110, CoC 24, CoC 22, CoV 94101 and Co 97009 (MC 707) in almost all the regions except Western region. Wilt was observed in SI 308, SI 309, CoC 24, Co 86032, Co 06022, CoV 92102 and CoV 09356 throughout the state at moderate level, however severe incidences were recorded on Co 06022 and CoV 09356. YLD was observed in the varieties Co 86032, CoV 09356, Co 06022, Co 06030, CoC 24, PI 1110, PI 1401, CoV 92102, CoV 94101, Co 0212, PI 951946 and PI 061346 in all the districts in varying intensities. Severe degeneration due to YLD was observed in all the popular varieties under cultivation. GSD was also observed in varying intensities across the varieties and regions. Pokkahboeng was observed in SI 308, Co 06022, Co 06030, CoV 09356, SI 339 and Co 86032. Its severity was felt in varieties like PI 1110, Co 06022 and CoV 09356. Rust and foliar diseases were recorded in Co 06022 and CoC 22. Leaf fleck caused by *Sugarcane bacilliform virus* (SCBV) has been found in all the regions especially on the varieties CoC 24, Co 0212, CoV 92102, Co 06030 and CoV 09356. This disease is found in rampant and gives a pale canopy in all these varieties more so in Co 0212.

2. PADEGAON

The survey of sugarcane diseases was undertaken in Kolhapur, Satara, Sangli, Ahmadnagar, and Solapur districts of Western Maharashtra. Smut incidence was noticed upto 11% on Co7219 at Kasbe-Digraj, Tal, Miraj, Islampur areas of district Sangli. The incidence of yellow leaf disease (YLD) was noticed in Udgaon, DattaShirole, Yadrav, Krundwad, Abduallaat, Narshiawadi villages from Shirole tahsil of Kolhapur district on Co 86032, CoC 671. The grassy shoot disease (GSD) was noticed in Baramati, Daund, Junner, Rahuri and Karadtahsil of Pune, Ahmadnagar and Satara districts on the sugarcane variety CoM 265, Co 86032 (ratoon).Pokka boeng was noticed on CoVSI 9805 and CoC 671 in Solapur district. The incidence of rust was noticed up to 25-30% in Kasbabavada, Shendapark, Dattashirol and Kurundwad area from Kolhapur district on the sugarcane variety CoM 0265, Co 92005, Co 86032. Moreover, 5-10% rust incidence was noticed on CoM 265 from Koregaon, Waitahsil of Satara district and ARS, Radhanagari of Kolhapur district. Brown spot was a major problem observed up to 5-20% predominantly in Satara, Sangli, Kolhapur, Ahmadnagar and Pune districts because of frequent rains and high humidity during rainy season in the vicinity of Yesgaon,Takali, Pohegaon Tal Kopergaon areas.The incidence of ring spot disease was noticed upto 5% in Shenda Park, Kasbabavada tahsil and ARS Radhanagri (7%) of Kolhapur district on the sugarcane varieties CoM 0265, Co 86032 and Co 92005 whereas trace incidence of pineapple disease was noticed on Co 86032 and CoM 0265.

3. THIRUVALLA

Very low incidence of red rot was observed only in few isolated pockets of Marayoor-Kanthalloor areas of Idukki District. Pokkah Boeng incidence was observed from two months onwards during the March - April but disease got subsided after the monsoon showers during July - August. Sheath blight due to *Rhizoctonia solani* was commonly observed in the field during May - June after the summer showers of April - May. Ring spot appeared during May-June and is seen up to harvest. It has been observed in almost of the varieties planted in the experimental field of the station and also in the farmer's field. Rust was observed during August- September months but the disease subsided with the onset of North East monsoon showers.Mosaic was seen commonly in most of the crop varieties, but the disease was not in such a stage to cause any severe yield reduction.

4. NAVSARI

Surveys were undertaken in ten sugarcane growing sugar factories area of South Gujarat region. The survey indicated that wilt, red rot and whip smut were the major diseases in South Gujarat region. Area affected under wilt, red rot and whip smut was 1.81, 1.32 and 4.90 per cent respectively. The incidence of whip smut was recorded on varieties like CoSi 95071, Co 86002, Co 97009 and Co 99004. Maximum incidence of whip smut was recorded in the varieties CoSi 95071, Co 86002 and Co 97009 and it was to the tune of 15.40 % in Kamrej Sugar factory area. The wilt incidence noticed in CoC 671, Co 86032, Co 86002, CoM 0265 and CoSi 95071 varieties and was maximum to the tune of 3.35 % in Gandevi Sugar factory. The red rot was recorded in the varieties of CoC 671, Co 86032, Co 86002, Co 0323, CoVSI 03102, CoVSI 0434 and Co 97009 and it was to the tune of 1-2.5 % in all Sugar factories area. Highest wilt and red rot incidence was noticed in variety CoC 671 and minimum in Co 86032. In addition to these diseases, the incidence of PB was observed in Co 99004 in Bardoli, Gandevi, and Kamrej Sugar factory areas. Grassy shoot, yellow leaf diseases were found in traces at Mahuva, Narmada, Bardoli sugar factory areas and also Navsari surrounding area. Grassy shoot was observed on Co 86032, CoC 671 and CoM 0265 and yellow leaf disease was noticed on Co 86032 and Co 99004.

5. PUNE

The incidence of smut has been increased in Central Maharashtra and Vidarbha in last year due to drought situation in last 2 crop seasons (2015-16 and 2016-17). The incidence was more in ratoon crops of Co 86032. Grassy shoot in sugarcane is increasing in all commercially cultivated varieties. The incidence is more in ratoon crops of CoM 0265, Co 86032 and Co 419. The incidence of foliar diseases on sugarcane crop *viz.*, rust, Pokkah boeng, yellow leaf, brown spot and eye spot is increasing. Due to late heavy rains coupled with hot & humid climate during September- October 2017, severe incidence of Pokkah boeng was observed in Adsali planted crop of 2017-18. The incidence of brown spot is decreasing, while the incidence of yellow leaf disease on sugarcane is increasing in the state. The incidence of yellow leaf disease in sugarcane is increasing in Kolhapur, Sangli, Satara, Pune, Ahmadnagar and Solapur districts and it was noted on CoM 0265 and Co 86032 up to 20%. The incidence of eye spot, mosaic and pineapple disease was observed in sugarcane crop in minor way. Pineapple was observed in heavily irrigated black cotton soils. The practice of settling transplanting in sugarcane is increasing and therefore the disease incidence is eliminated in such plots.

6. SANKESHWAR

The incidence of smut was observed 8.3 to 13.1%. In general, incidence of yellow leaf disease was low (1-2grade). Incidence of grassy shoot disease was noticed in most of the field surveyed (4.2-17.5%). The incidence of rust (10.1 to 15.4) in association with ring spot (15.5 to 20.7) was also observed. The incidence of pokkah boeng is increasing substantially and affecting most of the sugarcane varieties.

7. KOLHAPUR

The survey of sugarcane diseases was undertaken in Kolhapur, Sangli and Sindhudurg. Smut incidence was noticed upto 30% on CoM 261 at Bhadgaon, Tal. Gadhinglaj, Dist. Kolhapur. The incidence of GSD was found in the range of 1-10 % in the surveyed area. The incidence of brown spot was found on almost all commercially cultivated sugarcane varieties with varying intensities and incidence. However, the incidence of rust was found upto 5%. Incidence of ring spot was observed with high intensity due to favourable conditions. The incidence of Pokkah boeng was found upto 5%. The incidence of YLD was found mainly on Co 86032.

8. AKOLA

Roving survey of sugarcane fields of Vidarbha,Yavatmal m Wardha and Amravati, districts was carried out. In most of the fields,pokkah boeng, YLD and mosaic were the common problems on varieties CoM 0265 (Ratoon) and CoVSI 03102, Co 94012, Co 7701, Shidagiri and Co 3102 ranging 1- 5% severity.

PP 23: ASSESSMENT OF ELITE AND ISH GENOTYPES FOR RESISTANCE TO RED ROT

Objective: 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.

Locations: Kapurthala, Uchani, Karnal, Shahjahanpur, Lucknow, Pusa, Seorahi, Anakapalle, Cuddalore, and Navsari

Plot Size: One, six metre row of at least 10 clumps

No. of isolates: As indicated in PP 17 experiment

Method of inoculation: Plug method only

Inoculum: As per details given under PP 17 (Pathotypes to be inoculated individually only)

Method of evaluation: As per details in PP 17

RESULTS

NORTH WEST ZONE

1. KAPURTHALA

Of the 27 genotypes, nine genotypes namely, BM 1005149, GU 07-2276, MA 5/51, MA 5/99, SA 04-390, SA 04-454, SA 04-496, AS 04-1689 and MA-5/37 were found MR to both of the pathotypes CF08 and CF09.

2. KARNAL

Twenty seven ISH clones were inoculated with CF08 and CF09 isolates and among them15 clones showed R/MR reactions, seven MS and five S/HS reaction with CF08 isolate, while seven were R/MR, 12 MS and eight S/HS with CF09 isolate.

3. UCHANI

Nine ISH clones viz., IA 30-17, IA 30-14, IA 30-17, IA 31-32, IA 31-35, B 44-167, F1108, Q-65, Q-45 and 57 NG 131 were evaluated for red rot resistance using pathotype CF08. The clones namely IA 30-17, IA 31-35 and F 1108, were found resistant/moderately resistant whereas, genotypes IA 30-14, IA 31-32, B 44-167 Q-65, Q-45 and 57 NG 131 showed moderately susceptible/ susceptible reaction against red rot pathotype CF08.

4. SHAHJAHANPUR

Of 13 ISH genotypes, five namely AS 04-635, PG 9869137, SA 04-454, AS 04/1687 and GU 07-3849 were identified as MR against CF08. Six genotypes such as SA 04-409, BM 1005149, BM 1003143, MA 5/99, AS 04/2097 and SA 04-472 behaved as MS against CF08. Of 13 genotypes, five viz; BM 1005149, AS 04-635, AS 04/1687, AS 04/2097 and GU 07-3849 exhibited as MR and six genotypes were identified as MS to CF09.

5. LUCKNOW

The twenty six ISH genotypes received from ICAR-Sugarcane Breeding Institute, Regional Centre, Karnal during 2017-18 were multiplied and planted in spring season, 2018.

NORTH CENTRAL ZONE

1. PUSA

Out of 27 clones only single clone (GU 07/2276) was found R, nine clones (AS 04-1687, AS 04-1689, AS 04-390, MB-1005149, AS 04-454, AS 04-2097, AS 04-496, BM-1010168 and AS 04-98/13) were found MR, nine clones (BM-1009163, MB-1022173, MA-5/37, AS 04-635, CYMO-7986, GU 07/3849, MA-5/22, MA 5/99 and SA 04-472) were found MS and 8 clones (AS 04-245, GU 07/3774, MA-5/5, MA-5/51, PG-9869137, SA 04-458, SA 04-409 and BM-1003143) were found S when canes were inoculated with CF07. In case of CF08 inoculated clones, a single clone (AS 074-454) was observed R, 8 clones (AS 04-1689, AS 04-390, MB- 1005149, AS 04-2097, AS 04-496, MB-1010168, GU 07/2276 and AS 04-98/13) were found MR, nine clones (AS 04-1687, MB-1022173, MA-5/37, AS 04-245, CYMO-7986, MA 5/99, PG-9869137, SA 04/472 and SA 04-409) were MS and 9 clones (BM-1009163, AS 04-635, GU 07/3774, GU 07/3849, MA-5/22, MA-5/5, MA-5/51, SA 04-458 and BM 1003143) were observed as S to red rot.

2. SEORAHI

Twenty seven ISH genotypes were evaluated against red rot. Of these 11 genotypes were rated as MR, 9 genotypes as MS, 4 genotypes as S and one genotype was rated as HS to CF07. While, 12 genotypes were rated as MR, 7 genotypes as MS and 6 genotypes as S to CF08 and rest genotypes did not survive.

EAST COAST ZONE

1. CUDDALORE

Twenty seven ISH clones screened for red rot resistance by plug method using CF06 pathotype, in that two *viz*., SA 04-454 and GU 07-2276 recorded R reaction. Eleven genotypes *viz*., BM 1005149, BM 1010168, PG 9869137, SA 98-13, SA 04-390, SA 04-409, AS 04-2097, MA 5/37, MA 5/99, MA 5/22 and GU 07-3849 were MR to red rot. The genotypes *viz*., BM 1003143, SA 04-472, SA 04-496, AS 04-1689, AS 04-245, AS 04-635, AS 04-1687 and CYM 07-986 were MS and6 genotypes were HS to red rot.

2. ANAKAPALLE

Out of 27 ISH genotypes tested by plug method of inoculation, one entry (PG9869137) showed resistance

while 6 entries, SA 04-454, SA 04-496, AS 04-2097, MA 5/37, MA 5/99 and GU 07-2276 showed moderately resistant reaction to the pathotype CF06 and remaining were moderately susceptible to highly susceptible in reaction.

PENINSULAR ZONE

1. NAVSARI

Thirty elite and ISH genotypes were evaluated by plug method for resistance to a local isolate of *C. falcatum*. Three genotypes SES 594, BM 10 1068 and SA 04 454 gave resistant reaction. Fifteen genotypes, viz., ISH 111, ISH 58, ISH 100, ISH 287, ISH 147, ISH 267, ISH 118, ISH 117, ISH 114, ISH 115, MA 5/99, AS 04-1687, GU 07-2276, MA 5/22 and CYM 07 986 were observed with moderately resistant reaction. Five genotypes viz., ISH 175, ISH 12,ISH 50, ISH 229 and AS 04-2097 showed moderately susceptible reaction. Four genotypes viz., ISH 69, ISH 176, MA 5/5 and MA 5/51 exhibited susceptible reaction. Whereas, three genotypes viz., ISH 41, ISH 9 and ISH 43 showed highly susceptible reaction.

2. COIMBATORE

About 26 ISH/ IGH genotypes were screened against three new isolates of *C. falcatum* from Tamil Nadu viz., CfV09356-Ellanganur, Cf86032 Srikandapuram and CfC24-RSCL to assess their broad spectrum resistance to red rot. It was found that only five of them viz., BM 1010168, MA 5/37, MA 5/99, SA 04-390, SA 04-454 were resistant to all the three isolates and others exhibited a variable reaction.

PP 28: B. METHODOLOGY FOR SCREENING SUGARCANE GENOTYPES FOR RESISTANCE TO BROWN RUST (*Puccinia melanocephala*)

Objective :To standardize methodology for inoculation of uredospores of brown rust and rating of resistance.

Year of Start :2013-14

Locations :Pune, Kolhapur, Sankeshwar, Padegaon, and Anakapalle

Inoculation methodology

(i) Clip inoculation in leaf whorl

As soon as brown rust appears in field, select rust affected leaves, cut leaf bits (clips) measuring 8-10 cm. Select ten rust-free plants of the same susceptible variety in a different location. In three shoots of each plant (clump), insert 2-3 clips in the leaf whorl of each shoot.

(ii) Leaf whorl inoculation

As soon as brown rust appears in field, collect rust affected leaves. Make a suspension of uredospores in sterilized distilled water (10^4-10^5 spores/ml). Pour 1 ml freshly prepared uredospores suspension in each leaf whorl. Inoculate in 10 clumps (three shoots per clump) of same susceptible variety.

In the aforementioned two methods, plants to be inoculated may be marked by cutting one-third of the tips of the uppermost leaves so that they can easily be identified during recording observations.

Observations: After 4 weeks, record symptoms on leaves by counting –

(i) average number of rust pustules per square inch, and (ii) number of leaves bearing rust pustules.

(ii) Rating of resistance: To be taken up after standardization of inoculation method

RESULTS

1. PUNE

After one month of inoculation, the observations regarding the number of pustules on leaves were recorded. In leaf whorl method, there was high number of rust pustules (23.40/sq.inch). In clip inoculation, the average numbers of rust pustules per square inch were 13.20.

2. KOLHAPUR

In leaf whorl inoculation method, higher average no. of rust pustules (24.63 per sq. inch) and higher no. of leaves bearing rust pustules (12.4) was recorded as compared to the clip inoculation method (22.45 per sq. inch and 11.2, respectively).

3. SANKESHWAR

Out of two methods, more number of rust pustules were observed (31.91/sq.inch) in leaf whorl method. In clip inoculation, the average number of rust pustules was 25.85 per square inch.

4. PADEGAON

Higher average no. of rust pustules (30.28 per sq. inch) and higher no. of leaves bearing rust pustules (7.4) was recorded in the leaf whorl inoculation compared to the clip inoculation method (28.52 per sq. inch and 7.1 respectively). However, spraying with uredospores suspension (10^4-10^5 spores/ml) was tried which recorded still higher average no. of rust pustules (38.12 per sq. inch).

5. ANAKAPALLE

Among the concentrations of uredospores tested through leaf whorl method of inoculation, more number of rust pustules per square inch (24.6) were produced at

a concentration of 10^6 uredospores / ml in the variety CoA 92081. Four to five leaves showed rust pustules in leaf whorl method of inoculation when inoculated with a concentration of 10^6 uredospores / ml, whereas 4 to 5 leaves were infected at 10^5 and 10^4 concentrations.

PP 31: SCREENING, EPIDEMIOLOGY AND MANAGEMENT OF POKKAH BOENG IN SUGARCANE

Objectives : To study the development of pokkah boeng disease in relation to weather parameters and its management in sugarcane crop

Location :Kapurthala, Uchani, Shahjahanpur, PUSA, Seorahi, Anakapalle, Pune and Akola

Year of Start : 2011-2012

Observations to be recorded: Screening the desirable varieties for the incidence of pokkah boeng, correlation of climatic factors in relation to disease development and management of pokkah boeng under field conditions if the disease reaches acute phases.

(i) Screening

Symptoms to be observed:

Mild -Green plants with pokkah boeng (curling/twisting of spindle leaves, twisting of leaves, whitish/chlorotic streaks on the leaves) at varying intensities.

Moderate -Yellowing of 3rd/4th leaf followed by complete yellowing of foliage and expression of top rot symptom

Severe -Yellowing of leaves + Discoloration (Light colored) of silk +wilting symptom in opened stalks

Observe for the presence of above symptoms and grade it as given below

Varieties	%infected Plants				Disease reaction
	Mild	Moderate	Severe	Total incidence	
VI					
V2					
V3					

* No restriction on number of varieties to be studied

Disease Reaction

0-5% - Resistant; >5-10% - Moderately Susceptible; 10-20% - Susceptible;

20% - Highly Susceptible

(ii) Epidemiology

Record temperature, relative humidity and rainfall from May to September and establish correlation with disease incidence

(iii) Management

(To be taken up during second year of the Project)

Varieties: Two susceptible varieties

Treatments

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 May 15th)

T-3 Sett treatment (T1) +Foliar spray with carbendazim (T2)

T-4 Control

Replications: 4

Observations: Record disease incidence of pokkah boeng displaying symptoms of top rot or wilt or both and present the date in a tabular form.

RESULTS

I. SCREENING FOR POKKAH BOENG RESISTANCE

NORTH WEST ZONE

1. KAPURTHALA

Under natural condition 38 entries along with two check viz., Co 0238 and CoJ 85 were screened for PB resistance. Only three genotypes (Co 13034, CoPb 13181 and CoPant 13224) showed MS and CoPant 12221, CoLk 13204 and CoS 12232 were susceptible and remaining were resistant to pokkah boeng. However, check varieties Co 0238 and CoJ 85 behaved as HS and S to the disease, respectively.

2. UCHANI

Eighty three varieties of sugarcane were screened against pokkah boeng disease under natural conditions. Thirty one varieties viz., Co 12026, Co 12027, Co 12029, Co 13033, Co 13035, CoH 12263, CoH 13062, CoH 13063, CoH 14062, CoH 14261, CoH 150, CoH 160, CoH 166, CoH 167, CoH 92, CoH 99, CoLk 12203, CoLk 12205, CoLk 13203, CoLk 13205, CoLk 14202, CoLk 14204, CoPant 12226, CoPb 12211, CoPb 13183, CoPb 14182, CoPb 14184, CoPb 14211, CoPb 14212, CoS 767, and CoS 13231 were found resistant to PB. Forty four varieties namely, Co 0118, Co 0237, Co 05009, Co 05011, Co 1148, Co 13034, Co 13036, Co 14034, Co 14035, Co 7717, CoLk 14201, CoPb 14181, CoH 119, CoH 128, CoH 13261,

CoH 151, CoH 156, CoH 164, CoH 56, CoJ 64, CoJ 85, CoLk 13201, CoLk 13202, CoLk 14203, CoLk 14205, CoPant 12221, CoPant 13221, CoPant 13223, CoPant 13224, CoPant 97222, CoPant 14222, CoPb 13182, CoPb 14183, CoPb 14185, CoPb 13181, CoS 12232, CoS 13232, CoS 13233, CoS 14231, CoS 14232, CoS 14233, S 11252, S 11202 and S 11733 showed moderately susceptible reaction to pokkah boeng. Six varieties viz., CoH 110, CoH 133, CoH 152, CoLk 13204, CoPant 13222 and CoS 8436 exhibited susceptible reaction to pokkah boeng. However, Co 0238 variety showed highly susceptible reaction against pokkah boeng.

3. SHAHJAHANPUR

Of seventeen, nine genotypes/varieties were found to be resistant whereas six genotypes viz., S.5080/11, UP 9530, S. 5087/11, S. 5099/11, CoS 8436 and CoSe 12452 were screened as moderately susceptible. Two popular varieties (CoS 08279, Co 0238) were screened as susceptible.

NORTH CENTRAL ZONE

1. PUSA

Twenty varieties were screened under natural condition, out of which, eighteen varieties viz., BO 130, BO 155, CoLk 09204, CoLk 12207, CoLk 12209, CoP 11436, CoP 12436, CoP 12438, CoP 132, CoP 13437, CoP 13438, CoP 13439, CoP 2061, CoP 11438, CoSe 12451, CoSe 13451, CoSe 13452 and CoSe 13453 showing resistant reactions whereas, two varieties (CoP 11437 and CoBln 14502) showed moderately susceptible against pokkah boeng disease.

2. SEORAHI

Total 26 genotypes/varieties were utilized for the screening of pokkah boeng disease under natural condition. Out of 26 varieties 17 varieties viz., Co 0118, CoBln 14501, CoJ 64, CoLk 14201, CoLk 14206, CoLk 14207, CoP 13437, CoP 14437, CoP 14439, CoS 05011, CoSe 01421, CoSe 13451, CoSe 13452, CoSe 14232, CoSe 14451, CoSe 14453 and CoSe 14456 exhibited resistant (R), 7 varieties viz., CoP 14436, CoP 9301, CoSe 14454, CoP 14438, CoS 767, CoSe 95422 and CoS 12231 exhibited moderately susceptible (MS) and rest of them exhibited S behavior to pokkah boeng disease.

EAST COAST ZONE

1. ANAKAPALLE

Out of 34 genotypes screened against top rot disease under natural conditions less than 5% disease incidence was observed in seventeen genotypes, viz., Co 13023, Co 6907, Co 7706, CoA 14321, CoA 11326, CoA 13322, CoA 13323, CoA 89085, CoA 92081, CoC 13336, CoC 13337, CoC 14336, CoC 15336, CoC 15340, CoOr 13346, CoV 13356 and CoV 15356 which were rated as resistant. Eleven genotypes (Co 419, Co 997, Co 7219, Co 13028, Co 13029, Co 13031, Co 86249, CoA 14323, CoC 01061, PI 14377, PI 15376, and CoC 14337) recorded MS reaction with a disease score of >5 to 10%.

PENINSULAR ZONE

1. PUNE

Out of the 14, 8 varieties *viz.*, Co 419, Co 85004, Co 86032, Co 94012, CoM 0265, CoVSI 0309, CoVSI 03102 and CoVSI 0405 were observed free from the disease, while remaining 6 varieties *viz.*, CoVSI 9805, VSI 434, CoC 671, MS 10001, CoVSI 2000-01 and VSI 08005 were found susceptible.

2. KOLHAPUR

Out of 56 genotypes/entries, 49 viz., Co 11001, Co 11004, Co 11005, Co 11007, Co 11012, Co 11019, Co 12007, Co 12008, Co 12012, Co 12019, Co 12024, Co 13021, Co 13022, Co 14002, Co 14003, Co 14004, Co 14008, Co 14009, Co 14012, Co 14016, Co 14022, Co 14023, Co 14025, Co 14026, Co 14027, Co 14030, Co 14031, Co 14032, Co 86032, Co 94008, CoM 11081, CoM 11084, CoM 11086, CoM 12085, CoN 14072, CoN 14073, CoSnk 05103, CoSnk 14101, CoSnk 14102, CoSnk 14103, CoT 14366, CoT 14367, CoTI 14111, CoTI 14112, CoVc 14061, CoVc 14062, MS 14081, MS 14082, PI 14131, PI 14132, VSI 14121, VSI 14122 genotypes shown resistant reaction to pokkah boeng disease, whereas genotypes viz., Co 12009, Co 14006, Co 99004, CoC 671 , CoM 11082, CoM 11085, CoN 14071, CoN 14074, VSI 12121 were found moderately susceptible.

3. AKOLA

The incidence of Pokkah boeng was in range of 0.00 to 6.80 %. Out of 40 genotypes screened under IVT Early Plant , only CoC 671, Co 86032 and CoSnk 05103 showed susceptible reaction with PB incidence of 6.75, 6.67 and 6.80 % respectively and other genotypes viz., Co 13021, Co 13022, Co 14002, Co 14003, Co 14004, Co 14006, Co 14008, Co 14009, Co 14012, Co 14016, Co 14022, Co 14023, Co 14025, Co 14026, Co 14027, Co 14030, Co 14031, Co 14032, CoN 14071, CoN 14072, CoN 14073, CoN 14074, CoSnk 14101, CoSnk 14102, CoSnk 14103, CoT 14111, CoT 14112, CoT 14366, CoT 14367, CoVc 14061, CoVc 14062, MS 14081, MS 14082, PI 14131, PI 14132, VSI 14121, VSI 14122 remain as disease free . The incidence of Pokkah boeng disease was ranging from 0.00 to 6.80 %. CoSnk 05103 showed highest (6.80%) disease incidence. In AVT- I Plant, all 11 entries viz., Co 12007, Co 12008, Co 12009, Co 12012, Co 12019, Co 12024, Co 86032, CoC 671, CoM 12085, CoSnk 05103, VSI 12121 were found to be R. In AVT (Early)- Ratoon, the incidence of Pokkah

boeng disease was ranging from 0.86 to 8.48 %. CoC 671 showed highest (8.48%) disease incidence. In AVT (Midlate)- II Plant, the incidence of Pokkah boeng disease was ranging from 0.77 to 4.62 %. Co 99004 showed highest (4.62%) disease incidence. In AVT (Mid late) - Ratoon, the incidence of PB disease ranged from 1.28 to 6.50%. Co 11012 showed highest (6.50 %) disease incidence.

II. EPIDEMIOLOGY

In Kapurthala, The PB incidence of the disease initiated from 1st fortnight of June and gradually increased till September in relation to higher maximum-minimum temperature range (24.7 to 38.0 °C), relative humidity (53.42 to 75.45%) and higher rainfall. The severe incidence of the disease was observed in the months from July to September due to higher temperature, relative humidity and rainfall. Higher relative humidity (70 to 80 %) coupled with cloudy weather and drizzling favoured the growth and development of pathogen.

In Shahjahanpur, Pokkah boeng appeared during Ist fortnight of June and gradually increased till July to September due to high rainfall and humidity. Rainfall in July, August and September were recorded 170.0 mm, 246.4 mm and 132.5 mm, respectively. Relative humidity was recorded up to 85.0 per cent in July and August month and 78.0 per cent recorded in September.Rainfall and relative humidity play a major role in the incidence and spreading of PB.

In Uchani centre, the average maximum temperature 33.91°C (31.51-39,20°C) and minimum 25.07°C (22.21-26.60°C), average relative humidity morning 82.29 (62 00-93.43) per cent and evening 62.41 (33.00-79.00) per cent and with total rainfall 79.65 mm (av. 4.43 mm) were recorded from June-September (22- 39 met. week). Pokkah boeng incidence starts increasing during rainfall with high humidity conditions. Incidence on important varieties viz., CoS 0238 (24.0 %), CoH 133 (20.0%) CoS 8436 (17.0 %), CoJ 85 (12.0 %) and CoH 119 (9.0 %) was observed during June- September, 2017.

In Pusa, the disease appeared in the last week of May and remains till 1st week of September. The maximum incidence was observed during 2nd week of June to last week of July and gradually decreased. The minimum and maximum temperature ranged between 23.9 to 34.7^{0}C, relative humidity 64.7 to 90.5% and rainfall 43.8 to 432.6 mm, respectively were recorded from May to September. Humidity and rainfall play an important role in PB incidence.

In Seorahi, the incidence of pokkah boeng was compared with meteorological data for pathogenesis and disease development under natural conditions. It was noticed that temperature (25 to 32^o C), relative humidity (69 - 91%)) and rainfall (230 - 399 mm) during the year favoured disease development. The disease incidence was found maximum in first week of July which gradually increased till the last week of August. Maximum rainfall and high humidity favoured the development of pokkah boeng disease. The reduction in disease incidence was seen from the second week of July after the period of rain fall.

In Anakapalle, the disease incidence was initiated during the Ist fortnight of June and gradually increased till November and then the disease was slowdown. Highest disease incidence was observed during the month of October. The disease incidence was positively correlated with the number of rainy days, low temperature and high RH.

In Pune, the initiation of pokkah boeng noted in second week of June 2017. During disease initiation period, the minimum and maximum temperature was 22.62 ^{0}C and 38.70^{o}C respectively & humidity ranges from 20.71 % to 97.31 %. Maximum pokkah boeng disease incidence was observed during 27th to 34th meteorological weeks, while the incidence was reduced after 35th meteorological week.

III. POKKAH BOENG MANAGEMENT

KAPURTHALA

The efficacy of fungicide carbendazim for management of PB was tested on two susceptible varieties *viz*., Co 0238 and CoJ 85. The results revealed that fungicide carbendazim was significantly better to manage the disease in comparison to control. Sett treatment along with foliar spray at 15 days interval starting from May 15th (T_3) was the most effective to control the pokkah boeng. This treatment was also resulted higher germination and low disease incidence in comparison to other treatments.

1. UCHANI

The efficacy of fungicide carbendazim for management of PB was tested on two susceptible varieties *viz*., Co 0238 and CoS 8436. Overnight cane soaking with carbendazim 0.1% and foliar sprays with carbendazim was found most effective in checking the the PB which gave lowest disease incidence of 5.2 per cent and 4.0 per cent in Co 0238 and CoS 8436, respectively and also increase germination.

2. SHAHJAHANPUR

The efficacy of carbendazim fungicide for management of PB was tested on two varieties Co 0238 and CoS 08272. Results revealed that carbendazim significantly controlled the disease as compared to control. The treatment T_3i.e., sett treatment with carbendazim and foliar spray with carbendazim was found better in germination and most effective to control PB during the monsoon season followed by T_2 in both varieties. Highest germination 49.23% with low incidence of disease (2.47%) were recorded in Co

0238 and 48.13% germination and 2.57 per cent disease incidence recorded in CoS 08272.

3. ANAKAPALLE

For management of top rot, sett treatment + Foliar spray of carbendazim @ 0.05% showed the highest percent germination and also low disease incidence (84.16 and 5.84 respectively) compared to other treatments.

4. SANKESHWAR

The experiments on management revealed that sett treatment with Carbendazim @ 0.1% and three foliar spraying with Carbendazim @ 0.05% at 15 days interval showed the maximum (86.54%) per cent germination and also low disease incidence (5.49%) of PB.

5. PUNE

For management of PB, the fungicides viz., carbendazim and mancozeb were found effective when sprayed thrice after 15th may onwards. The maximum disease control (75.22 %) was obtained by 3 foliar spray of Mancozeb @ 0.3% at an interval 15 days from 15th May. However, carbendazim use by 3 sprays is also found beneficial to control the disease effectively.

PP 32: MANAGEMENT OF BROWN SPOT DISEASEOF SUGARCANE

Objective :To find out effective method of brown spot management through chemicals.

Locations :Pune, Padegaon, Kolhapur and Sankeshwar

Year of Start : 2015-16

Treatment

I. Variety :Brown spot susceptible variety CoM 0265 (or local susceptible variety)

II. Fungicides

T.1- Propiconazole		-	0.1 %
T.2	- Hexaconazole	-	0.1 %
T.3	- Triadimefon	-	0.1 %
T.4	- Mancozeb	-	0.3 %
T.5	- Carbendazim	-	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.

Plot size : 6 x 7 sq. m

Design : RBD

Replications : Three

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

RESULTS

1. PADEGAON

The intensity of brown spot, growth and quality parameters as influenced by different treatments were recorded. All the fungicides had a significant influence on the brown spot intensity, cane yield and CCS yield. Among the treatments, Propiconazole 0.1 % recorded the lowest brown spot intensity of 10.00 % and the highest per cent disease control of 84.46 %, total height 226.00 cm, No. of internode 19.87, internode length 12.77 cm, NMC/ha of 89.68, cane yield of 103.80 t/ha and CCS yield of 14.67 t/ha. It was followed by Mancozeb 0.10 % which recorded the brown spot intensity of 13.00 % and the per cent disease control of 79.79 %, total height 223.67 cm, No. of internode 19.43, internode length 12.38 cm, NMC/ha of 86.28, cane yield of 98.0 t/ha and CCS yield of 14.26 t/ha.

2. KOLHAPUR

The experiment is vitiated due to low incidence of the disease and non feasibility of spraying of various fungicides (as per treatment) due to flood condition during rainy season.

3. SANKESHWAR

Among the treatments, Propiconozole 0.1% recorded the lowest disease intensity of 11.0% disease control 82.43 followed by Mancozeb 0.3% which recorded the disease intensity of 14.0% disease control of 78.3%.

4. PUNE

The sugarcane crop under this project remains free from the incidence of brown spot and therefore, the treatments are not imposed. The project was vitiated.

PP 33: MANAGEMENT OF YELLOW LEAF DISEASE THROUGH MERISTEM CULTURE

RESULTS

1. COIMBATORE

Field experiments were conducted to assess impact of YLD on cane growth and yield by comparing the crops planted with virus-infected and virus-free planting materials of the popular varieties Co 86032 and Co 0238 and a new variety Co 11015. It was found that the virus-free plants have recorded significantly higher values in sett germination, plant growth/yield parameters such as number of stalks, cane diameter, cane length, number of internodes, cane weight, juice yield etc. It was found that due to virus infection, cane and juice yield are reduced in the range of 18.5-40.7 and 42.1-50%, respectively in the plant crop.

2. ANAKAPALLE

Tissue culture plantlets of sugarcane cultivars, CoA 14321, CoA 92081 and CoV 08356 were raised and transplanted under field conditions. Yellow leaf incidence was not observed in breeder seed crop and foundation seed crop raised from tissue culture seedlings. Virus indexing of tissue culture plantlets of sugarcane through RT-PCR revealed the absence of SCYLV in tissue culture plantlets of sugarcane cultivars, CoA 14321, CoA 92081 and CoV 08356 obtained from tissue culture lab, RARS, Anakapalle. The indexing of tissue culture plantlets of sugarcane obtained from Navabharath Ventures, Samalkot has revealed the presence of ScYLV in the sugarcane cultivars, Co 86032, Co 06030 and 2007A 81.

3. PUNE

The tissue culture plantlets of 2 varieties viz., Co 86032 and VSI 08005 were produced as per the standard procedure being followed at VSI, Pune. Properly hardened TC plantlets are transplanted in the field for the production of breeder seed and observed throughout the year for the incidence of YLD.

4. CUDDALORE

The work on meristem tip culturing of sugarcane was initated. Young cane tops of variety CoC 25 was collected from 4 month old crop, apical dome was excised with help of a sterile sharp blade and placed in glass bottle containing modified MS medium supplemented with kinetin (0.015 mg/l), benzyl adenine (1.0 mg/l) and sucrose (30 g/l). The apical domes are incubated at 25° ± 1°C under 16 hr / 8 hr light-dark cycle. The work is being continued for production of meristem tip culture.

Table 1: Reaction of ZVT entries for red rot, smut and wilt (North West Zone-I)

Sl. No.	Genotype	Red rot													Smut		Wilt		YL
		Lucknow				Kapurthala				Uchani									
		Plug Method		Nodal Method		Plug Method		Nodal Method		Plug Method		Nodal Method							
		CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	YL	Lucknow	Kapurthala	Lucknow	Kapurthala	Lucknow
Initial Varietal Trial (Early)																			
1.	Co 14034	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MS	MS	MR	S	MS	R
2.	CoLk 14201	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MS	R	MR	R	R	R
3.	CoLk 14202	R	R	R	R	MR	MR	R	R	MR	MR	R	R	MS	MS	MR	R	R	R
4.	CoPant 14221	MR	MR	MR	MR	-	-	-	-	-	-	-	-		R	-	R	-	R
5.	CoPant 14222	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	S	MR	R	S	R	R
6.	CoPb 14181	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MS	MS	MS	R	MS	R
7.	CoPb 14182	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MR	MR	R	S	R	S
8.	CoPb 14211	MS	MR	MR	MR	MR	MR	R	R	MS	MS	R	R	MS	S	MR	S	MR	R
Advanced Varietal Trial (Early)-I Plant																			
1.	Co 13034	MR	MR	R	R	MS	MR	R	R	MR	MR	R	R	S	R	MS	R	MR	R
2.	CoPb 13181	MR	MR	R	R	MS	MS	R	R	S	MS	R	R	MS	R	MR	R	R	R
3.	CoS 13231	MR	S	MR	MS	MR	MR	R	R	MR	MR	R	R	MR	S	R	R	R	R
Advanced Varietal Trial (Early)-II Plant																			
1.	Co 12026	S	S	S	S	MR	MR	R	R	MS	MR	R	R	MS	R	MR	R	R	R
2.	Co 12027	R	R	R	R	MR	MR	R	R	MR	MS	R	R	MS	MR	MS	R	R	R
3.	CoLk 12203	MR	MR	MR	MR	MS	MS	R	R	MR	MS	R	R	MS	R	MS	R	MS	R
4.	CoPant 12221	MS	MS	MS	MS	MS	MR	R	R	MR	MR	R	R	MS	S	MS	R	R	R
Initial Varietal Trial (Midlate)																			
1.	Co 14035	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MS	MS	MR	R	MR	R
2.	CoH 14261	MR	MR	MR	MR	MR	MR	R	R	R	MR	R	R	MS	R	R	R	R	R
3.	CoH 14262	MR	MR	R	R	MR	MR	R	R	MR	R	R	R	MR	R	MR	R	R	R
4.	CoLk 14203	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MR	R	S	R	R	R
5.	CoLk 14204	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	S	MS	R	R	R	R
6.	CoLk 14205	R	R	R	R	MR	MR	R	R	MS	MR	R	R	MR	MS	MS	S	R	R
7.	CoPb 14183	MR	MR	R	R	MR	MR	R	R	MS	MS	R	R	MR	S	MS	R	R	R
8.	CoPb 14184	MR	MR	MR	MR	MR	MR	R	R	MR	R	R	R	MR	MR	R	R	R	R
9.	CoPb 14185	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MR	MR	MR	S	R	S
10.	CoPb 14212	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MR	MS	R	S	R	S
11.	CoS 14231	S	S	MS	MS	MS	MS	R	R	S	MS	S	R	MR	MS	MS	S	MS	R
12.	CoS 14232	MR	MR	MR	MR	MR	MR	R	R	MR	R	R	R	S	S	R	S	R	R
13.	CoS 14233	MR	MR	MR	MR	S	S	S	S	MR	R	R	R	MR	MS	MR	R	R	R
Advanced Varietal Trial (Mid late)-I Plant																			
1.	Co 13035	MR	MR	MR	MR	S	MS	R	R	MR	MR	R	R	MS	R	MS	R	R	S

Sl. No.	Genotype	Red rot													Smut		Wilt		YL
		Lucknow				Kapurthala				Uchani									
		Plug Method		Nodal Method		Plug Method		Nodal Method		Plug Method		Nodal Method							
		CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	YL	Lucknow	Kapurthala	Lucknow	Kapurthala	Lucknow
2.	CoH 13263	MR	MR	MR	MR	MS	S	R	R	MR	MR	R	R	R	R	MR	R	MS	R
3.	CoLk 13204	MR	MR	MR	MR	MS	MS	R	R	MS	MS	R	R	S	MR	S	S	R	R
4.	CoPant 13224	MR	MR	MR	MR	MR	MR	R	R	MR	MS	R	R	MS	R	MR	R	MR	R
5.	CoPb 13182	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	S	MR	MS	S	R	R
Advanced Varietal Trial (Mid late)-II Plant																			
1.	Co 12029	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MS	MS	MS	R	R	R
2.	CoH 12263	MR	MR	MR	MR	MS	MR	R	R	MR	MR	R	R	MR	R	MR	R	R	R
3.	CoLk 12205	MR	MR	MR	MR	MS	MS	R	R	MS	MS	R	R	MS	MR	S	R	R	R
4.	CoPant 12226	MS	MS	MR	MR	MR	MR	R	R	MR	MR	R	R	MS	MS	MR	R	MR	R
5.	CoPb 12211	MS	MS	MR	MR	MR	MR	R	R	S	MS	R	R	MS	MS	MR	R	R	R
6.	CoS 12232	MR	MR	MR	MR	MS	MS	R	R	MS	MR	R	R	S	R	MS	R	MR	R
Check																			
1	CoJ 64*	HS	S	S	S	HS	HS	S	S	HS	S	S	S	MS	-	S	-	-	-
2	CoS 767*	MS	S	MR	MS	HS	HS	S	S	MS	S	R	R	MS	-	S	-	-	-
3	Co 1158**	-	-	-	-	-	-	-	-	-	-	-	-	-	S	HS	-	-	-
4	CoLk 7701**	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-	-
5	Co 0238	-	-	-	-	MR	MR	R	R	MR	MR	R	R	S	-	S	-	-	-
6	Co 05009	-	-	-	-	MR	MR	R	R	MR	MR	R	R	MS	-	MR	-	-	-
7	CoS 8436	-	-	-	-	MR	MR	R	R	MR	MR	R	R	MS	-	MS	-	-	-
8	CoPnt 97222	MR	MR	R	R	S	S	S	S	S	MS	S	S	S	MR	MS	R	-	-
9	Co 05011	MR	MR	MR	MR	MR	MR	R	R	MR	MR	R	R	MS	R	MR	S	-	-
10	Co 740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-
11	Co 7915	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	-	-	-
12	Co 62175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-
13	NCo 310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-
14	Katha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-
15	Co 7717	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-
16	Co 89003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-

Table 2: Reaction of ZVT entries for red rot, smut and wilt (North West Zone-II)

Sl. No.	Genotype	Red rot													Smut		YLD	
		Shahjahanpur				Pantnagar				Karnal								
		Plug Method		Nodal Method		Plug Method		Nodal Method		Plug Method		Nodal Method		YLD	Shahjahanpur	Pantnagar	Shahjahanpur	Pantnagar
		CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09					
AVT Early (I Plant)																		
1	Co 13034	MR	MS	R	R	MS	MS	R	R	R	R	R	R	R	R	MS	R	R
2	CoPb 13181	S	MS	S	R	S	S	R	R	S	MS	R	R	MS	R	R	R	MS
3	CoS 13231	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MS	MR	R	R	MR
AVT Early (II Plant)																		
1	Co 12026	MR	MS	R	R	MR	R	R	R	MR	MR	R	R	MR	MR		R	
2	Co 12027	MR	MR	R	R	-	-	-	-	MR	R	R	R	MR	MR	-	R	-
3	CoLk 12203	MR	MR	R	R	MR	MR	R	R	MS	MR	R	R	MR	R	MR	R	R
4	CoPant 12221	MR	MR	R	R	MR	MR	R	R	MS	MR	R	R	MR	MS	MS	R	MR
AVT Mid late (I Plant)																		
1	Co 13035	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MS	S	MR	R
2	CoH 13263	S	HS	S	S	MR	MR	R	R	MS	MS	R	R	R	R	MS	R	MR
3	CoPant13224	MS	MS	R	R	MS	MS	R	R	MS	MS	R	R	R	R	MR	MR	MR
4	CoPb 13182	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	MR	R	R
5	CoLk 13204	MS	S	R	S	R	MR	R	R	MS	MS	R	R	MR	MR	MR	R	MS
AVT Mid late (II Plant)																		
1	Co 12029	MR	MR	R	R	MR	MS	R	R	MR	MR	R	R	R	MR	MS	R	R
2	CoH 12263	MS	MS	R	R	MR	MR	R	R	MS	MS	R	R	R	R	R	R	R
3	CoLk 12205	MS	MR	R	R	MR	MR	R	R	MS	MS	R	R	MR	MS	S	R	R
4	CoPant 12226	MR	MS	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	MR	MR	R
5	CoPb 12211	MS	MS	R	R	MR	MR	R	R	S	MS	R	R	MR	R	MS	R	R
6	CoS 12232	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	R	MR	R	R
IVT Early																		
1	Co14034	MS	MS	R	R	MR	MR	R	R	MR	MR	R	R	R	R	MS	R	R
2	CoLk 14201	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R
3	CoLk 14202	MR	MR	R	R	-	-	-	-	MR	MR	R	R	MR	R	-	R	-
4	CoPant 14222	MR	MR	R	R	-	-	-	-	MR	MR	R	R	R	MR	-	MR	-
5	CoPb 14181	MR	MS	R	R	MS	MR	R	R	MR	MR	R	R	R	MR	MR	R	MR
6	CoPb 14182	MR	MR	R	R	MS	MR	R	R	MR	MR	R	R	R	MS	MS	R	MR
7	CoPb 14211	MS	MS	R	R	-	-	-	-	MS	MS	R	R	R	R	-	MR	-
IVT Mid late																		
1	Co 14035	MR	MR	R	R	-	-	-	-	R	MR	R	R	MR	R	-	R	-

Sl. No.	Genotype	Red rot													Smut		YLD	
		Shahjahanpur				Pantnagar				Karnal								
		Plug Method		Nodal Method		Plug Method		Nodal Method		Plug Method		Nodal Method						
		CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	YLD	Shahjahanpur	Pantnagar	Shahjahanpur	Pantnagar
2	CoH 14261	MR	MR	R	R	-	-	-	-	R	MR	R	R	MR	MR	-	MR	-
3	CoH 14262	R	MR	R	R	-	-	-	-	R	R	R	R	MR	R	-	MR	-
4	CoLk 14203	MR	MR	R	R	MR	MR	R	R	R	MR	R	R	MS	R	MS	R	R
5	CoLk 14204	MR	MR	R	R	MR	MR	R	R	R	MR	R	R	R	MR	R	R	R
6	CoLk 14205	MR	MS	R	R	-	-	-	-	MR	MS	R	R	R	MR	-	R	-
7	CoPb14183	MS	MR	R	R	MR	MS	R	R	MS	MS	R	R	R	MR	-	R	R
8	CoPb 14184	MR	MR	R	R	MS	MR	R	R	MR	R	R	R	R	R	MS	R	R
9	CoPb 14185	MR	MR	R	R	-	-	-	-	MR	R	R	R	R	MR	-	R	-
10	CoPb 14212	MR	MS	R	R	MR	MS	R	R	MR	MR	R	R	R	R	R	R	R
11	CoS 14231	MR	MS	R	R	-	-	-	-	S	MS	S	R	R	R	-	R	-
12	CoS 14232	MR	MR	R	R	MR	R	R	R	MR	MR	R	R	R	MS	MS	R	R
13	CoS 14233	MR	MS	R	R	MR	MR	R	R	S	MS	S	R	MR	R	HS	MR	R
Check																		
1	CoJ 64	HS	HS	S	S	S	S	S	S	S	S	S	S	S	MR	MS	R	MR
2	Co 0238	MR	MS	R	R	-	-	-	-	MR	R	R	R	MR	R	-	R	-
3	Co 05009	MR	MR	R	R	-	-	-	-						R	-	R	-
4	CoS 767	HS	HS	S	S	MS	S	R	R	S	S	S	R	S	R	MS	R	MR
5	CoS 8436	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MS	R	MS	MS	R
6	CoPant 97222	S	HS	R	S	MR	MR	R	R	MS	MS	R	R	MR	R	-	R	R
7	Co 05011	MR	MR	R	R	-	-	-	-	-	-	-	-	-	R	-	MS	-
8	Co 1158	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	S	-
9	CoPant 84211	-	-	-	-	MR	MS	R	R	MS	MS	R	R	S	-	-	-	MS

Table 3: Reaction of ZVT entries for red rot, smut and wilt (North Central & North East Zones)

S. No	Genotypes	Red rot																	Smut		Wilt		YLD	
		Motipur				Seorahi				Pusa				Buralikson				Motipur	Seorahi	Pusa	Motipur	Pusa	Motipur	Seorahi
		CF07		CF08		CF07		CF08		CF07		CF08		CF07		CF08								
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal							
IVT (Early)																								
1.	CoBln 14501	MR	MR	MR	MR	MS	R	MR	R	MS	R	MS	R	-	-	-	-	R	R	MR	R	MR	S	R
2.	CoLk 14206	MR	MR	MR	MR	MR	R	MR	R	MS	R	MR	R	-	-	-	-	S	MS	R	R	R	R	R
3.	CoLk 14207	MR	MR	MR	MR	MR	R	MR	R	MS	R	MR	R	-	-	-	-	R	R	R	S	MR	R	R
4.	CoP 14436	MR	MR	MR	MR	MR	R	MR	R	MS	R	MR	R	-	-	-	-	R	R	R	S	MR	S	R
5.	CoP 14437	MS	MR	MS	MR	MR	R	MS	R	MR	R	R	R	-	-	-	-	S	S	R	R	R	S	R
6.	CoSe 14451	MR	MR	MR	MR	MR	R	MR	R	MR	R	MR	R	-	-	-	-	S	MR	R	S	MR	S	MS
7.	CoSe 14453	MR	MR	MR	MR	MR	R	MR	R	MR	R	MR	R	-	-	-	-	R	R	R	R	R	R	MS
8.	CoSe 14454	MR	MR	MS	MR	MR	R	MR	R	MS	S	MR	S	MR	MR	R	R	R	R	MR	R	S	R	MS
AVT (Early)-I Plant																								
1.	CoP 13437	MS	MR	MS	MR	S	R	S	S	-	-	-	-	MR	R	S	R	S	MS	-	R	-	R	R
2.	CoSe 13451	MR	MR	MR	MR	MS	R	MR	R	-	-	-	-	R	MR	R	R	R	R	-	S	-	S	R
3.	CoSe 13452	R	R	R	R	MR	R	MR	R	-	-	-	-	MR	MR	R	R	R	R	-	R	-	R	R
AVT (Early)-II Plant																								
1.	CoLk 12207	MR	MR	MR	MR	-	-	-	-	-	-	-	-	MR	MR	R	R	MR	-	-	R	-	R	-
2.	CoP 12436	MR	MR	S	MS	-	-	-	-	-	-	-	-	MR	MR	R	R	MR	-	-	R	-	S	-
3.	CoSe 12451	MR	MR	MR	MR	-	-	-	-	-	-	-	-	MR	MR	R	R	MR	-	-	S	-	R	-
4.	CoP 11436	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	
5.	CoP 11437	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	
6.	CoP 11438	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	R	S	-	-	-	-	-	-	-
IVT (Mid late)																								
1.	CoBln 14502	MR	MR	MR	MR	S	S	MR	R	S	S	S	S	MR	MR	R	R	R	R	MR	R	MS	R	R
2.	CoLk 14208	MR	MR	MR	MR	MR	R	MR	R	MS	R	MR	R	-	-	-	-	R	R	R	R	MS	S	R
3.	CoLk 14209	MR	MR	MR	MR	MR	R	MR	R	MR	R	MR	R	-	-	-	-	R	R	R	S	R	R	R
4.	CoLk 14210	R	R	R	R	MR	R	MR	R	MR	R	MR	R	-	-	-	-	R	R	R	S	MR	S	R
5.	CoP 14438	MR	R	MR	R	MS	R	MS	R	MR	R	R	R	-	-	-	-	R	R	R	R	MR	R	S
6.	CoP 14439	MR	MR	MR	MR	MR	R	MR	R	MR	R	MR	R	-	-	-	-	R	R	R	R	MR	R	R
7.	CoSe 14452	R	R	MR	R	MR	R	MR	R	MR	R	MR	R	-	-	-	-	R	R	R	R	MR	R	R
8.	CoSe14455	MR	MR	MR	MR	MR	R	MR	R	MS	R	MR	R	-	-	-	-	R	R	R	R	R	R	R
9.	CoSe 14456	MR	MR	MR	MR	MR	R	MR	R	MR	S	MS	R	-	-	-	-	R	R	MR	S	MR	R	R
AVT (Mid late)-II Plant																								
1.	CoLk 09204	MR	MR	MR	MR	-	-	-	-	-	-	-	-	MR	MR	R	R	R	-	-	R	-	R	-

S. No	Genotypes	Red rot																Smut		Wilt		YLD	
		Motipur				Seorahi				Pusa				Buralikson									
		CF07		CF08		CF07		CF08		CF07		CF08		CF07		CF08							
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Motipur	Seorahi	Pusa	Motipur	Pusa	Motipur	Seorahi
2.	CoLk 12209	MR	MR	MR	MR	-	-	-	-	-	-	-	-	MR	MR	R	R	MR	-	-	R	-	S	-
3.	CoP 12438	MR	MR	MR	MR	-	-	-	-	-	-	-	-	MR	MR	R	R	MR	-	-	R	-	S	-
4.	CoSe 12453	R	R	MR	MR	-	-	-	-	-	-	-	-	MR	MR	S	S	MR	-	-	R	-	R	-
5.	CoSe 11453	-	-	-	-	-	-	-	-	-	-	-	-	R	MR	R	R	-	-	-	-	-	-	-
6.	CoSe 11454	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	-
7.	CoSe 11455	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	-
8.	CoP 11451	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	-
Checks																								
	CoSe 95422*	S	S	S	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	BO130	MR	R	MR	R	-	-	-	-	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	-
	CoP 06436	MR	R	MR	R	MR	R	MR	R	MR	R	R	R	-	-	-	-	-	R	R	-	R	-	R
	BO 91	MR	R	MR	R	MR	R	MR	R	MR	R	MR	R	MR	MR	R	R	-	R	MR	-	MR	-	R
	CoJ 64*	HS	S	HS	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Co 1158**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	HS	-	-	-	-	-
	CoLk 7701**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-	-	-	-
	CoP 9301	-	-	-	-	MR	R	MR	R	MR	R	MR	R	MR	MR	R	R	-	R	R	-	R	-	R
	CoLk 94184	-	-	-	-	MR	R	MR	R	MR	R	MR	R	-	-	-	-	-	R	R	-	MR	-	R
	CoSe 95422	-	-	-	-	S	R	S	S	MS	S	MS	S	R	MR	R	S	-	R	MR	-	S	-	R
	CoSe 01421	-	-	-	-	MR	R	MS	R	MR	R	MR	R	-	-	-	-	-	MS	MR	-	R	-	R
	BO 155	-	-	-	-	-	-	-	-	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	-
	CoBln 7501	-	-	-	-	-	-	-	-	-	-	-	-	R	R	R	R	-	-	-	-	-	-	-
	Akipura	-	-	-	-	-	-	-	-	-	-	-	-	MS	MS	S	S	-	-	-	-	-	-	-

Table 4: Reaction of ZVT entries for red rot, smut and wilt (East Coast Zone)

Sl.No.	Genotypes	Anakapalle									Cuddalore					
		Red rot						Smut	Wilt	YLD	Red rot				Smut	YLD
		CF04		CF05		CF06					CF04		CF06			
		Plug	Nodal	Plug	Nodal	Plug	Nodal				Plug	Nodal	Plug	Nodal		
IVT – Early																
1.	CoC 15336	R	R	R	R	R	R	HS	S	R	-	-	MR	R	MR	MR
2.	CoC 15337	-	-	-	-	-	-	-	-	-	-	-	MR	R	MR	MR
3.	CoC 15338	-	-	-	-	-	-	-	-	-	-	-	MR	R	MR	MS
4.	CoV 15356	MR	R	MR	R	MR	R	HS	R	R	-	-	MR	R	S	MS
IVT- Midlate																
1.	CoC 15339	MR	R	MR	R	MR	R	HS	MR	MS	-	-	MR	R	MR	MS
2.	CoC 15340	S	R	S	R	S	R	HS	S	S	-	-	MR	R	MR	MR
3.	CoOr 15346	-	-	-	-	-	-	-	-	-	-	-	MR	R	-	MR
4.	PI 15376	HS	R	HS	R	HS	R	HS	MR	R	-	-	MS	S	S	MR
5.	PI 15377	S	R	S	R	S	R	HS	R	R	-	-	HS	S	S	MS
AVT – Early I Plant																
1.	Co 13023	MR	R	MR	R	MR	R	MR	MR	R	-	-	MR	R	MS	MR
2.	CoA 14321	R	R	R	R	MR	R	MR	R	R	-	-	MR	R	MS	MS
3.	CoC 14336	MS	R	MS	R	MS	R	HS	MS	R	-	-	MR	R	MS	MS
AVT – Early II Plant																
1.	CoA 13322	MR	R	MR	R	MR	R	MS	MR	S	-	-	MR	R	MS	MR
2.	CoA 13323	MR	R	MR	R	MR	R	MS	MS	S	-	-	MS	R	S	MR
3.	CoC 13336	MS	R	MS	R	MS	R	HS	S	R	-	-	MR	R	MS	MS
4.	CoC 13337	S	R	S	R	S	R	MR	S	MS	-	-	MR	R	MR	MR
5.	CoV 13356	MR	R	MR	R	MR	R	MR	S	R	-	-	MS	R	MR	MS
AVT- Midlate I Plant																
1.	Co 13028	R	R	R	R	R	R	MR	MR	R	-	-	MR	R	MR	MS
2.	Co 13029	MR	R	MR	R	MR	R	S	MS	R	-	-	MR	R	MS	MR
3.	Co 13031	MR	R	MR	R	MR	R	MR	R	R	-	-	MR	R	MR	R
4.	CoA 14323	MR	R	MR	R	MR	R	MS	MR	R	-	-	MR	R	MS	MS
5	CoC 14337	MR	R	MR	R	MR	R	HS	MR	R	-	-	MR	R	MR	MS
6.	PI 14337	MR	R	MR	R	MR	MR	MR	MR	R	-	-	MR	R	MS	MR
AVT- Midlate Plant II																
1.	CoA 11326	MR	R	MR	R	MR	R	S	MS	R	-	-	MR	R	MS	MR
2.	CoA 12324	MR	R	MR	R	MR	R	S	R	R	-	-	MS	R	MR	MR
3.	CoC 13339	MR	R	R	R	R	R	HS	R	MR	-	-	MR	R	MR	MR
4.	CoOr 13346	MS	R	MS	R	MS	R	MS	R	R	-	-	MR	R	MS	MS

Sl.No.	Genotypes	Anakapalle									Cuddalore					
		Red rot						Smut	Wilt	YLD	Red rot				Smut	YLD
		CF04		CF05		CF06					CF04		CF06			
		Plug	Nodal	Plug	Nodal	Plug	Nodal				Plug	Nodal	Plug	Nodal		
Checks																
1	Co 419	HS	S	HS	S	HS	S	HS	S	R	-	-	-	-	-	-
2	Co 997	HS	S	HS	S	HS	S	S	HS	MR	-	-	-	-	-	-
3	Co 6907	HS	S	S	S	HS	S	HS	S	MR	-	-	-	-	-	-
4	Co 7219	S	R	S	R	S	R	HS	S	R	-	-	-	-	-	-
5	Co 7706	HS	R	HS	R	HS	R	HS	MR	R	-	-	-	-	-	-
6	CoC 671	HS	S	HS	S	HS	S	HS	S	MR	-	-	HS	S	HS	HS
7	CoA 89085	S	S	S	S	S	S	HS	MR	R	-	-	-	-	-	-
8	CoA 92081	R	R	R	R	R	R	HS	MS	MS	-	-	-	-	-	-
9	CoC 01061	MR	R	MR	R	MR	R	S	R	MS	-	-	-	-	-	-
10	Co 86249	MR	R	MR	R	MR	R	MS	MR	S	-	-	R	R	HS	MS

Table 5: Reaction of ZVT entries for red rot, smut and YLD (Peninsular Zone)

Sl No.	Genotypes	Red rot										Smut							YLD		
		Coimbatore				Thiruvalla				Navsari											
		CF06		CF12		CF06		CF12													
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Coimbatore	Navsari	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Sankeswar	Kolhapur
Initial Varietal Trial – Early																					
1	Co 13021	-	-	-	-	MR	R	MR	R	MS	R	MS	MR	R	R	-	-	MS	MR	R	MR
2	Co 13022	-	-	-	-	MR	R	MS	R	HS	R	HS	MS	R	R	-	-	MS	MR	R	R
3	Co 14002	-	-	-	-	MS	R	MR	R	MS	R	MR	S	MS	HS	-	-	S	R	R	R
4	Co 14003	-	-	-	-	MR	R	MR	R	HS	R	R	R	R	MR	-	-	R	R	R	MR
5	Co 14004	-	-	-	-	MR	R	MR	R	MR	R	S	R	MR	MR	-	-	S	R	R	R
6	Co 14006	-	-	-	-	MR	R	MR	R	MR	R	R	MR	R	R	-	-	S	R	R	R
7	Co 14008	-	-	-	-	MR	R	MR	R	MS	R	MS	MR	MR	R	-	-	MR	R	R	R
8	Co 14009	-	-	-	-	MR	R	MS	R	MR	R	R	R	R	R	-	-	MS	R	R	R
9	Co 14012	-	-	-	-	MR	R	MR	R	MR	R	HS	HS	MR	R	-	-	S	R	R	MR
10	Co 14016	-	-	-	-	MR	R	MS	R	MR	R	HS	HS	MR	R	-	-	R	MR	R	R
11	Co 14022	-	-	-	-	MS	R	MS	R	HS	R	MR	MR	MS	S	-	-	R	R	R	R
12	Co 14023	-	-	-	-	MR	R	MS	R	HS	S	S	S	MS	MS	-	-	MS	MR	MR	R
13	Co 14025	-	-	-	-	MS	R	MS	R	HS	R	MR	R	MS	MS	-	-	MR	R	R	**R**
14	Co 14026	-	-	-	-	MR	R	MR	R	MR	R	MR	MS	MR	R	-	-	R	R	R	R
15	Co 14027	-	-	-	-	MR	R	MR	R	MS	R	MS	HS	MR	R	-	-	R	S	R	R
16	Co 14030	-	-	-	-	MR	R	MS	R	S	R	MR	MS	MR	MR	-	-	S	MR	S	**R**
17	Co 14031	-	-	-	-	MR	R	MS	R	HS	R	S	HS	HS	MS	-	-	R	S	R	**R**
18	Co 14032	-	-	-	-	MR	R	MR	R	MR	R	R	R	HS	S	-	-	R	R	R	R
19	CoN 14071	-	-	-	-	MR	R	MR	R	MR	R	R	R	R	R	-	-	R	R	R	R
20	CoN 14072	-	-	-	-	MS	R	MR	R	MR	R	MR	R	R	R	-	-	R	R	R	R
21	CoN 14073	-	-	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	-	-	R	R	R	R
22	CoN 14074	-	-	-	-	MR	R	MR	R	MR	R	MS	R	R	R	-	-	R	R	R	R
23	CoSnk 14101	-	-	-	-	MS	R	MS	R	HS	S	HS	R	R	R	-	-	R	R	R	MR
24	CoSnk 14102	-	-	-	-	MR	R	MR	R	MR	R	MR	MS	R	R	-	-	MS	R	R	R
25	CoSnk 14103	-	-	-	-	MR	R	MS	R	MR	R	MR	MR	R	R	-	-	R	S	R	MS
26	CoT 14366	-	-	-	-	MR	R	MS	R	S	R	S	HS	S	R	-	-	R	MR	R	R
27	CoT 14367	-	-	-	-	MR	R	MR	R	MS	R	R	R	R	S	-	-	MS	R	R	R
28	CoTl 14111	-	-	-	-	MR	R	MR	R	MR	R	HS	HS	MR	R	-	-	HS	R	R	R
29	CoTl 14112	-	-	-	-	S	S	MS	S	HS	R	MS	HS	MR	MR	-	-	R	R	R	R
30	MS 14081	-	-	-	-	MR	R	MS	R	MS	R	HS	MR	MR	MR	-	-	R	MR	R	R
31	MS 14082	-	-	-	-	MR	R	MR	R	MR	R	R	R	R	R	-	-	MS	MR	R	R

Sl No.	Genotypes	Red rot										Smut							YLD		
		Coimbatore				Thiruvalla				Navsari											
		CF06		CF12		CF06		CF12													
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Coimbatore	Navsari	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Sankeswar	Kolhapur
32	CoVc 14061	-	-	-	-	S	S	S	S	HS	R	HS	S	R	MR	-	-	R	R	R	R
33	CoVc 14062	-	-	-	-	MR	R	MS	R	MR	R	S	MR	S	R	-	-	MS	R	R	R
34	PI 14131	-	-	-	-	MS	S	S	S	MS	R	S	HS	MR	R	-	-	MR	R	R	R
35	PI 14132	-	-	-	-	MS	S	S	S	HS	R	MS	HS	MR	R	-	-	R	R	R	R
36	VSI 14121	-	-	-	-	HS	S	HS	S	HS	R	MR	MR	R	R	-	-	R	R	R	R
37	VSI 14122	-	-	-	-	MS	R	MR	R	HS	S	HS	R	MR	R	-	-	MS	R	R	R
38	Co 13002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
39	Co 13003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
40	Co 13004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
41	Co 13072	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
42	CoN 13071	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
43	CoSnk 13101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	-	-	-	-	-
44	CoSnk 13102	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
45	MS 13081	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
AVT – Early I Plant																					
1	Co 12007	-	-	-	-	MS	R	MS	R	HS	R	-	HS	MR	R	-	-	S	R	R	MR
2	Co 12008	-	-	-	-	MR	R	MS	R	MS	R	-	HS	MS	MS	-	-	R	S	R	MR
3	Co 12009	-	-	-	-	MS	S	MS	S	MR	R	-	HS	MS	MR	-	-	MS	R	R	R
4	Co 12012	-	-	-	-	MS	R	MS	R	S	R	-	S	MR	MR	-	-	R	R	R	R
5	Co 12019	-	-	-	-	MR	R	MS	R	MR	R	-	R	MR	MR	-	-	R	MR	R	R
6	Co 12024	-	-	-	-	S	S	S	S	MR	R	-	MR	R	-	-	-	R	R	R	S
7	CoM 12085	-	-	-	-	S	S	S	S	HS	R	-	MR	MR	R	-	-	R	MR	R	R
8	VSI 12121	-	-	-	-	MS	S	S	S	MS	R	-	MS	MR	R	-	-	HS	R	R	R
AVT – Early II Plant																					
1	Co 11001	-	-	-	-	MS	R	MS	R	MR	R	-	R	MR	MR	MS	-	-	R	R	MR
2	Co 11004	-	-	-	-	MR	R	MR	R	MR	R	-	HS	MR	MS	MS	-	-	R	R	MR
3	CoM 11081	-	-	-	-	MS	R	MS	R	MR	R	-	MS	MR	R	MS	-	-	R	R	MR
4	CoM 11082	-	-	-	-	MS	R	MS	R	MR	R	-	S	R	MS	R	-	-	R	R	R
5	CoM 11084	-	-	-	-	MR	R	MS	R	MR	R	-	R	MR	MR	MS	-	-	R	R	R
6	Co 10004	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
7	Co 10005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
8	Co 10006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
9	Co 10024	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-

Sl No.	Genotypes	Red rot										Smut							YLD		
		Coimbatore				Thiruvalla				Navsari											
		CF06		CF12		CF06		CF12													
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Coimbatore	Navsari	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Sankeswar	Kolhapur
10	Co 10026	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
11	Co 10027	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
12	CoT 10366	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
13	CoT 10367	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
AVT – Midlate II Plant																					
1	Co 11005	-	-	-	-	MS	R	MS	R	MS	R	-	R	MR	R	R	-	HS	R	R	MS
2	Co 11007	-	-	-	-	MR	R	MR	R	MR	R	-	MS	MR	MR	MS	-	R	R	R	MR
3	Co 11012	-	-	-	-	MR	R	MS	R	MR	R	-	S	R	R	MS	-	R	R	R	MR
4	Co 11019	-	-	-	-	MS	R	MS	R	HS	R	-	R	R	R	MS	-	S	R	R	R
5	CoM 11085	-	-	-	-	MS	S	MS	S	HS	R	-	R	MR	MR	R	-	R	R	R	R
6	CoM 11086	-	-	-	-	MR	R	MR	R	MS	R	-	R	R	R	R	-	R	R	R	R
7	Co 09009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
8	Co 10015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
9	Co 10017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	-	-	-	-	-
10	Co 10031	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-	-	-
11	Co 10033	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
12	CoM 10083	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
13	CoT 10368	-	-	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-
14	CoT 10369	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
15	CoVc 10061	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-	-	-
16	PI 10131	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
17	PI 10132	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-	-	-
Checks																					
1	Co 86032	-	-	-	-	MS	S	S	S	HS	R	-	MR	MR	R	-	-	R	S	R	S
2	CoC 671	-	-	-	-	HS	S	HS	S	HS	S	-	MR	MR	R	-	-	R	R	R	R
3	CoSnk 05103	-	-	-	-	MR	R	MR	R	MR	R	-	MR	-	R	-	-	R	R	R	MR
4	Co 85004	-	-	-	-	MR	R	MR	R	S	R	-	HS	R	R	-	-	R	MS	R	-
5	Co 94008	-	-	-	-	MR	R	MR	R	MR	R	-	-	R	R	-	-	R	R	R	MR
6	Co 99004	-	-	-	-	MR	R	MR	R	MR	R	-	MS	MS	R	-	-	HS	MR	R	MR
7	Co 97009	-	-	-	-	-	-	-	-	-	-	HS	HS	-	-	-	-	-	-	-	-
8	Co 86002	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-	-	-	-	-	-
9	Co 6806	-	-	-	-	-	-	-	-	-	-	R	MR	-	-	-	-	-	-	-	-
10	Co 96007	-	-	-	-	-	-	-	-	-	-	HS	-	-	-	-	-	-	-	-	-

Sl No.	Genotypes	Red rot										Smut							YLD		
		Coimbatore				Thiruvalla				Navsari											
		CF06		CF12		CF06		CF12													
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Coimbatore	Navsari	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Sankeswar	Kolhapur
11	Co 419	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-	-	-	-	-
12	Co 740	-	-	-	-	-	-	-	-	-	-	-	-	HS	R	MS	-	S	-	R	-
13	Co 7527	-	-	-	-	-	-	-	-	-	-	-	-	S	R	-	-	-	-	-	-
14	CoM 0265	-	-	-	-	-	-	-	-	-	-	-	-	R	R	-	-	-	-	-	-
15	MS 10001	-	-	-	-	-	-	-	-	-	-	-	-	R	R	-	-	-	-	-	-
16	CoM 09057	-	-	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-	-	-
17	Co 7219	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	MS	-	-	-	-	-

Summary

- During 2017-18, eleven AICRP(S) projects were conducted under Plant Pathology discipline at 22 AICRP(S) centres (regular and voluntary) in all the five sugarcane producing zones in India.
- Differential host studies to identify variation in red rot pathotype, the experiments were conducted at 12 centres in four zones with 84 new isolates along with designated pathotypes. More number of variants have been isolated from the popular varieties such as Co 0238, CoJ 64, Co 89003, CoLk 8102, CoS 8436, CoSe 92423, CoV 09356, CoSe 95422, and CoC 24. The new isolates of *C. falcatum* behaved almost similar to the existing pathotypes with limited variations. However, there is possible emergence of new pathotypes from Co 0238, CoS 8436, Co 89003 and Co 94012.
- At fifteen AICRP(S) centres, the zonal varietal screening experiments were carried out for red rot testing, smut, wilt and YLD resistance. Large numbers of entries in tropical and sub tropical regions of the country were identified as R/MR to red rot and R to smut, wilt and YLD.
- Cotton Swab Nodal method has been found consistent reaction across the centres for red rot testing. Many centres also recorded YLD resistance in the ZVT entries.
- During 2017-18, survey of sugarcane diseases was done in major sugarcane area of the country. The incidence of red rot was found in sugarcane varieties (CoSe 95422, CoS 8436 and CoSe 92423). The incidence of smut was observed at several locations mostly affecting the sugarcane varieties viz., CoSe 92423, CoS 88230, CoS 91269 and Co 0238 (1-5%). Incidence of GSD was noticed in most of the fields surveyed (1-5 %) on sugarcane varieties CoS 91269 (10-20 %) and Co 0238 (5-10 %). The incidence of Pokkah boeng was significant in Co 0238. Sporadic incidence of leaf scald was also noticed in Co 0238. In tropical region, the incidence of red rot disease in varieties *viz.*, CoC 24 and Co 91017 and the disease severity ranged from 2 to 22 %. Smut disease was recorded in variety CoC 22 and CoSi 6, TNAU Si 8 and the disease severity ranged between 2 and 16 %. Wilt disease was observed in Co 86032 and CoV 09356 (2 to 14 %) and yellow leaf disease was noticed in Co 86032 (5 to 25 %), PI 1401 (5 to 10 %), PI 001110 (5 to 10 %) and CoV 09356 (5 to 15 %).
- Apart from red rot which continue to occupy prime importance in traditional sugarcane growing areas, there is a growing importance of Pokkah Boeng and Smut in subtropical region. In tropical India, the severity of Yellow Leaf Disease and Brown Rust increased.
- Occurrence of YLD, wilt, rust, *pokkah boeng* and brown spot to varying proportions were recorded in different states of the country. YLD occurrence is reported from all the states especially in epidemic proportions in tropical region.
- The work on rust inoculation methods revealed that Leaf Whorl Inoculation method is ideal for disease development. Useful information has been generated on *pokkah boeng* epidemiology and management.
- Clean seed programme initiated after virus elimination through tissue culture technique combined with molecular diagnosis was found to be effective to rejuvenate degenerated sugarcane varieties and management of Yellow Leaf Disease. Sugarcane crop raised through clean seed nurseries recorded more cane yield per hectare.

4. ENTOMOLOGY

Sugarcane hosts a considerable number of insect-pests. Some of them having an economic impact on sugarcane farmers and industries. A few major pests in different zones cause significant damage to all parts of sugarcane crop (root, stalk and foliage). The zone wise IVT, AVT genotypes, survey and monitoring of insect-pests, bio-agents, multiplication of bio-agents and hosts and validation of IPM module are conducted under AICRP (S).

The following five experiments in Entomology discipline were allotted to different centres during 2017-18 and summary of achievements is discussed below.

E.4.1 : Evaluation of zonal varieties/genotypes for their reaction against major insect-pests

E. 28 : Survey and surveillance of sugarcane insect-pests

E. 30 : Monitoring of insect-pests and bio-agents

E.34 : Standardization of simple and cost effective techniques for mass multiplication of sugarcane bio-agents

E.38 : Formulation and validation of IPM Module of sugarcane insect-pests

E. 4.1: Evaluation of zonal varieties/genotypes for their reaction against major insect pests

North Western Zone

1. Kapurthala

Thirty eight genotypes fourteen early maturing (seven under IVT E, three under AVT E I plant and four under AVT E II plant) and twenty four mid-late maturing (thirteen IVT ML, five AVT ML I plant and six AVT ML II plant) with respective standards were evaluated against early shoot borer, top borer and stalk borer. Early shoot borer incidence was low in all the tested genotypes except CoLk14202, CoPant12221, CoS14233. The cumulative incidence of top borer ranged from 5.76 % in Co 14035 (IVT ML) to 16.24 per cent in CoLk 14205 (IVT E). The per cent incidence of stalk borer ranged from 6.67 per cent in Co 14035 (IVT ML) to 17.33 per cent in CoS 14233 (IVT ML). However, the genotypes under six different groups showed less susceptible reaction to stalk borer.

2. SBI-RC Karnal

In AVT Early 1st plant trial, four genotypes and one standard check were evaluated against early shoot borer, top borer, root borer and stalk borer. All the genotypes including standard check were LS to early shoot borer and top borer and HS to stalk borer. Co0238 showed MS and rests of the genotypes were found HS to root borer. In AVT Early 2ndPlant trial, three genotypes and one standard check were evaluated against early shoot borer, top borer, root borer and stalk borer. All the genotypes including standard check were LS to early shoot borer and top borer and HS to stalk borer. Co0238 and CoPant12221 were MS and rests of the genotypes were HS to root borer. In AVT Mid late I Plant, all the genotypes including standard check were LS to early shoot borer and top borer and HS to stalk borer. CoLk13204, CoPant13224 and standard check Co5011 were MS and rests of the genotypes were HS to root borer. In AVT Mid late II Plant trial, all the genotypes including standard check were LS to early shoot borer and top borer and HS to stalk borer. CoPant13224 HS and rests of the genotypes were MS to root borer.

3. Shahjahanpur

In AVT (Early) I Plant trial, four sugarcane genotypes, CoS 13231, CoPb 13181, Co 13034, Co 05009 and two standard checks viz., CoJ 64 and Co 0238 were evaluated against major insect-pests. CoS 13231, CoPb 13181, Co13034, Co 05009 and Co 0238 were LS while CoJ 64 was MS to early shoot borer. Sugarcane genotypes; CoS 13231, CoPb 13181 and Co 13034 showed LS reaction while Co 05009 and both two standard checks showed MS reaction to top borer. CoS 13231, CoPb 13181, Co 13034 and Co 05009 and CoJ 64 showed LS reaction while Co 0238 MS reaction to stalk borer.

In AVT (Early) II Plant trial, four sugarcane genotypes, CoPant 12221, CoLk 12203, Co 12026 and Co 12027 and two standard checks as taken in I plant were evaluated against major insect-pests. CoPant12221, CoLk 12203, Co12026 and Co12027 and both of the checks showed less susceptible reaction to shoot borer. At harvest, the varieties CoLk12203, Co12026 and Co12027 and CoJ 64 (6.67%) showed LS reaction while the CoPant12221 and Co0238 showed MS reaction to top borer. Co12026 and Co12027 and CoJ64 showed LS while CoPant12221, CoLk12203 and Co0238 showed MS reaction to stalk borer.

In AVT (Mid Late) I Plant Trial, five genotypes and three standard checks were evaluated against major insect -pests. Based on cumulative incidence of early shoot borer, CoPb13182, CoH13263, Co13035, CoLk13204, and four standards checks, CoS767, CoPant97222, CoS8436 and Co05011 were LS while CoPant13224 was MS to early shoot borer. CoPb13182, CoPant13224, CoH13263, CoLk13204 and three standards checks were LS while the Co13035 and one standard CoS8436 were MS to top borer. CoPb13182, CoH13263, Co13035 and two standards CoS767, CoPant97222 were LS while CoPant13224 and two standard checks CoS8436 and Co05011 were MS to stalk borer. CoLk13204 was found HS.

In AVT (Midlate) II Plant, six genotypes CoPant12226, CoLk12205, CoH12263, Co12029, CoPb12211, CoS12232 and three same standard checks as taken in I plant were evaluated against major insect-pests. CoPant12226, CoLk12205, CoH12263, CoPb12211 and CoS12232 and all three standards checks were LS while Co12029 was MS to shoot borer. CoPant12226, CoPb12211, and CoS12232 and all three standard checks were LS while CoLk12205, CoH12263, and Co12029 were MS to top borer and stalk borer. CoPant12226, Co12029 and CoS12232 two standard checks CoS767 and CoS8436 showed LS reaction while CoLk12205, CoH 12263 and CoPb12211 and a standard check, CoPant 97222 showed MS.

4. Lucknow

AV T (Early) I Plant

In early maturing group, 4+2 sugarcane genotypes viz., Co 12027, CoS 13231, CoLk 12203, CoPant 12221 and two standard (Co 0230 and CoJ 64) and in mid late maturing group 13+2 genotypes viz., Co 05011, Co 13035, Co 12263, Co 12029, CoH 13263, CoPb 12211, CoPb 13181, CoLk 12205, CoLk 13204, CoS 12232, CoPant 12226, CoPant 13224, and two standards (CoS 767 and CoPant 97222, CoS 8436) were screened against major insect-pests of sugarcane. In early group, incidence of top borer II, III and IV brood ranged from15.67 to 40.33, 11.29 to 26.37 and 14.35 to 33.33 per cent, respectively. Incidence and intensity of stalk borer borer ranged from 3.02 to 9.03 and 0.73 to 4.23 percent, respectively. Incidence and intensity of internode borer ranged 5.08 to 16.74 and 1.19 to 5.52 percent, respectively.

In mid late group, incidence of top borer II, III and IV brood ranged from 12.05 to 34.44, 6.06 to 22.06 and 9.85to 46.09 per cent, respectively. Incidence and intensity of internode borer ranged from 6.87 to 16.68 percent and 1.28 to 5.93, respectively. Incidence and intensity of stalk borer ranged from 4.14 to 17.14 and 0.65 to 6.62 percent, respectively. Seven genotypes viz., CoLk 12205, CoS 12232, Co 13035, CoLk 13204, Co 05011, Co 12263, CoS 8436 were MS and rests of the genotypes were HS to top borer 2nd brood. CoS 12232 was LS and rests of the genotypes were MS to Top Borer 3rd brood. Co 05011 was LS to Top Borer IV brood and MS to 2nd and 3rd brood. CoS 767 and five genotypes viz., CoLk 12205, CoS 12232, CoPb 12211, Co 12263 were MS and rests of the genotypes were HS to top borer 4th brood.

5. Uchani

A total of thirty-eight genotypes of sugarcane comprising seven under IVT (Early), three under AVT (Early)-I Plant, four under AVT (Early)-II Plant, thirteen under IVT-Midlate, five under AVT (Midlate)-I Plant and six under AVT (Midlate)-II Plant with three standards for early and four for midlate were screened against major insect-pests of sugarcane.

In IVT- Early, all genotypes and standard checks were LS to early shoot borer. Two genotypes, CoLk 14201 and CoPant 14222, five genotypes, Co 14034, CoLk 14202, CoPb 14181, CoPb 14182 and CoPb 14211 and one genotype, Co 05009 were LS, MS and HS to top borer, respectivity. Out of seven, two genotypes (CoLk 14202 and CoPb 14182) were MS and rests were LS to stalk borer. In the case of root borer, only CoLk 14201 and CoPb 14182 showed MS reaction and rests of the genotypes showed LS reaction.

In AVT (early) –I Plant, all entries were LS to early shoot borer. Co 13034 and Co 05009 were LS and HS to top borer, respectively and rests of genotypes were MS. All the genotypes including standards were LS to stalk borer. CoJ 64, Co 0238 and Co 05009 were MS to reet borer and rests were found LS.

In AVT (early) - II Plant, all genotypes including standard checks were LS to early shoot borer, stalk borer, root borer and MS to top borer.

In IVT mid-late trial, thirteen genotypes were evaluated for their reaction against major insect-pests of sugarcane and CoS 767, CoS 8436, CoPant 97222 and Co 05011were also kept as standard checks. All the genotypes and standard checks were LS to early shoot and variable reaction of these genotypes were recorded against top borer. Three genotypes, Co 14035, CoLk 14203 and CoPb 14185 were HS to top borer. CoPb 14185, CoS 8436 and Co 05011 were MS and rests of the genotypes were moderately susceptible (MS) to stalk borer. Genotypes, Co 14035, CoPb 14212, CoS 14233 and Co 05011 were MS and rests of the genotypes were LS to root borer.

In AVT (Midlate)- I Plant, five entries were evaluated. All genotypes were reported LS to early shoot borer. Top borer incidence ranged from 5.1 to 21.1% in all tested genotypes.

Four genotypes, CoPb 13182, CoLk 13204, CoPant 97222, Co 05011, three genotypes, CoH 13263, CoPant 13224, CoS 767 and two genotypes, CoS 8436, Co 13035 showed LS, MS and HS reactions, respectively. All entries were found LS against stalk borer except CoPant 13224,Co 8436 and Co 05011. All tested genotypes were found least susceptible against root borer except CoPant 13224 and Co 05011(check).

All genotypes evaluated in AVT midlate –II Plant against early shoot borer were found LS. CoPant 97222 LS and CoLk 12205, CoPant 12226 was HS and rests of the genotypes rated as MS to top borer. All the genotypes except CoPb 12111 and CoS 8436 (check) were rated LS to stalk borers. All genotypes were LS to root borer. All genotypes in IVT Early and mid late , AVT Early I &II Plant and AVT Mid late I & II plant were LS to sucking pests.

North West Zone

1. Kapurthala

IVT Early					AVT (Early) I-Plant				AVT (Early) II-Plant			
Sl No.	**Variety**	ESB	TB*	StB	**Variety**	ESB	TB*	StB	**Variety**	ESB	TB*	StB
1.	Co 14034	LS	LS	LS	Co 13034	LS	LS	LS	Co 12026	LS	LS	LS
2.	CoLk 14201	LS	LS	LS	CoPb 13181	LS	LS	LS	Co 12027	LS	LS	LS
3.	CoLk 14202	MS	MS	LS	CoS 13231	LS	MS	LS	CoLk 12203	LS	MS	LS
4.	CoPant 14222	LS	MS		-	-	-	-	CoPant 12221	MS	MS	LS
5.	CoPb 14181	LS	LS		-	-	-	-	-			
6.	CoPb 14182	LS	LS		-	-	-	-	-			
7.	CoPb 14211	LS	MS		-	-	-	-	-			
CK	Co 05009	LS	LS	LS	Co 05009	LS	LS	LS	Co 05009	LS	LS	LS
	Co 0238	LS	MS	LS	Co 0238	LS	MS	LS	Co 0238	LS	MS	LS
	CoJ 64	LS	MS	LS	CoJ 64	LS	MS	LS	CoJ 64	LS	MS	LS

IVT (Midlate)					AVT (Midlate) I-Plant				AVT (Midlate) II-Plant			
Sl No.	**Variety**	ESB	TB*	StB	**Variety**	ESB	TB*	StB	**Variety**	ESB	TB*	StB
1.	Co 14035	LS	LS	LS	Co 13035	LS	LS	LS	Co 12029	LS	LS	LS
2.	CoH 14261	LS	LS	LS	CoH 13263	MS	MS	LS	CoH 12263	LS	LS	LS
3.	CoH 14262	MS	MS	LS	CoPant 13224	LS	MS	LS	CoLk 12205	LS	MS	LS
4.	CoLk 14203	LS	LS	LS	CoPb 13182	LS	MS	LS	CoPant 12226	MS	MS	LS
5.	CoLk 14204	LS	LS	LS	CoLk 13204	LS	LS	LS	CoPb 12211	LS	MS	LS
6.	CoLk 14205	LS	MS	LS	-	-	-	-	CoS 12232	LS	LS	LS
7.	CoPb 14183	LS	MS	LS	-	-	-	-				
8.	CoPb 14184	LS	LS	LS	-	-	-	-				
9.	CoPb 14185	LS	LS	LS	-	-	-	-				
10.	CoPb 14212	LS	LS	LS	-	-	-	-				
11.	CoS 14231	LS	MS	LS	-	-	-	-				
12.	CoS 14232	LS	MS	LS	-	-	-	-				
13.	CoS 14233	MS	MS	LS	-	-	-	-				
CK	Co 05011	LS	LS	LS	Co 05011	LS	LS	LS	Co 05011	LS	LS	LS
	CoPant 97222	LS	LS	LS	CoPant 97222	LS	LS	LS	CoPant 97222	LS	MS	LS
	CoS 8436	LS	MS	LS	CoS 8436	LS	LS	LS	CoS 8436	LS	MS	LS
	CoS 8436	LS	MS	LS	CoS 8436	LS	MS	LS	CoS 8436	LS	MS	LS

2. Uchani

Initial Varietal Trial (Early)									
Sl.No.	Variety	ESB	TB	StB*	RB	Pyrilla	Whitefly	Black bug	Web mite
1.	Co 14034	LS	MS	LS	LS	LS	LS	LS	LS
2.	CoLk 14201	LS	LS	LS	MS	LS	LS	LS	LS
3.	CoLk 14202	LS	MS	MS	LS	LS	LS	LS	LS
4.	CoPant 14222	LS	LS	LS	LS	LS	LS	LS	LS
5.	CoPb 14181	LS	MS	LS	LS	LS	MS	LS	LS
6.	CoPb 14182	LS	MS	MS	MS	LS	LS	LS	LS
7.	CoPb 14211	LS	MS	LS	LS	LS	LS	LS	LS
	CoJ 64	LS	MS	LS	LS	LS	MS	LS	LS
	Co 0238	LS	MS	LS	LS	LS	LS	LS	LS
CK	Co 05009	LS	HS	LS	LS	LS	MS	LS	LS
AVT (Early)-I Plant									
1.	Co 13034	LS	LS	LS	MS	LS	LS	LS	LS
2.	CoPb 13181	LS	MS	LS	LS	LS	LS	LS	LS
3.	CoS 13231	LS	MS	LS	MS	LS	LS	LS	LS
	CoJ 64	LS	MS	LS	LS	LS	MS	LS	LS
	Co 0238	LS	MS	LS	LS	LS	LS	LS	LS
CK	Co 05009	LS	HS	LS	LS	LS	MS	LS	LS
AVT (Early)-II Plant									
1.	Co 12026	LS	MS	LS	LS	LS	LS	LS	LS
2.	Co 12027	LS	MS	MS	LS	LS	LS	LS	LS
3.	CoLk 12203	LS	MS	LS	LS	LS	LS	LS	LS
4.	CoPant 12221	LS	MS	LS	LS	LS	LS	LS	LS
	CoJ 64	LS	MS	LS	LS	LS	MS	LS	LS
CK	Co 0238	LS	MS	LS	LS	LS	LS	LS	LS
IVT (Midlate)									
1.	Co 14035	LS	HS	LS	MS	LS	LS	LS	LS
2.	CoH 14261	LS	MS	LS	LS	LS	LS	LS	LS
3.	CoH 14262	LS	LS	LS	LS	LS	LS	LS	LS
4.	CoLk 14203	LS	HS	LS	LS	LS	LS	LS	LS
5.	CoLk 14204	LS	LS	LS	LS	LS	LS	LS	LS
6.	CoLk 14205	LS	MS	LS	LS	LS	LS	LS	LS
7.	CoPb 14183	LS	MS	LS	LS	LS	LS	LS	LS
8.	CoPb 14184	LS	MS	LS	LS	LS	LS	LS	LS
9.	CoPb 14185	LS	HS	MS	LS	LS	MS	LS	LS
10.	CoPb 14212	LS	LS	LS	MS	LS	MS	LS	LS
11.	CoS 14231	LS	MS	LS	LS	LS	LS	LS	LS
12.	CoS 14232	LS	MS	LS	LS	LS	LS	LS	LS
13.	CoS 14233	LS	MS	LS	MS	LS	MS	LS	LS
	CoS 767	LS	MS	LS	LS	LS	LS	LS	LS
	CoS 8436	LS	MS	MS	LS	LS	LS	LS	LS
CK	CoPant 97222	LS	LS	LS	LS	LS	LS	LS	LS
	Co 05011	LS	LS	MS	MS	LS	LS	LS	LS
AVT (Midlate)-I Plant									
1.	Co 13035	LS	HS	LS	LS	LS	LS	LS	LS
2.	CoH 13263	LS	MS	LS	LS	LS	LS	LS	LS
3.	CoPant 13224	LS	MS	LS	MS	LS	LS	LS	LS
4.	CoPb 13182	LS	MS	LS	LS	LS	LS	LS	LS
5.	CoLk 13204	LS	LS	LS	LS	LS	LS	LS	LS

CK	CoS 767	LS	MS	LS	LS	LS	LS	LS	LS
	CoS 8436	LS	HS	MS	LS	LS	LS	LS	LS
	CoPant 97222	LS	LS	LS	LS	LS	LS	LS	LS
	Co 05011	LS	LS	MS	MS	LS	LS	LS	LS
AVT (Midlate)-II Plant									
1.	Co 12029	LS	MS	LS	LS	LS	LS	LS	LS
2.	CoH 12263	LS	MS	LS	LS	LS	LS	LS	LS
3.	CoLk 12205	LS	MS	LS	LS	LS	LS	LS	LS
4.	CoPant 12226	LS	HS	LS	LS	LS	LS	LS	LS
5.	CoPb 12211	LS	MS	MS	LS	LS	LS	LS	LS
6.	CoS 12232	LS	MS	LS	LS	LS	LS	LS	LS
CK	CoS 767	LS	MS	LS	LS	LS	LS	LS	LS
	CoS 8436	LS	MS	MS	LS	LS	LS	LS	LS
	CoPant 97222	LS	LS	LS	LS	LS	LS	LS	LS

3. SBI-RC, Karnal

AVT (Ratoon)							**AVT –I Plant**				
Sl. No.	Variety / Genotypes	Black bug	ESB	TB	RB	StB	Variety / Genotypes	ESB	TB	RB	StB
1.	CoH 11262	LS	LS	LS	MS	LS	CoPb 13181	LS	LS	HS	L
2.	CoLk 11201	LS	LS	LS	LS	LS	Co 0238	LS	LS	MS	LS
3.	CoLk 11202	LS	LS	LS	MS	LS	CoS 13231	LS	LS	HS	LS
4.	CoLk 11203	LS	LS	LS	MS	LS	Co 13034	LS	LS	HS	MS
5.	Co 0238	LS	LS	LS	HS	LS	CoLk 13204	LS	LS	MS	MS
6.	Co 11027	LS	LS	LS	MS	LS	CoPb 13182	LS	LS	HS	MS
7.	CoH 11263	LS	LS	LS	MS	LS	CoH 13263	LS	LS	HS	MS
8.	CoLk 11204	LS	LS	LS	MS	LS	CoPant 13224	LS	LS	MS	MS
9.	CoLk 11206	LS	LS	LS	HS	LS	Co 13035	LS	LS	HS	MS
10.	CoPb 11214	LS	LS	LS	MS	LS	Co 05011	LS	LS	MS	LS
11.	CoS 11232	LS	LS	LS	HS	LS	-	-	-	-	-
12.	Co 05011	LS	LS	LS	MS	LS	-				

AVT –II Plant					
Sl.No.	Variety/Genotypes	ESB	TB	RB	StB
1.	CoPant 12221	LS	LS	MS	MS
2.	Co 12027	LS	LS	HS	MS
3.	Co 12026	LS	LS	HS	MS
4.	CoLk 12203	LS	LS	HS	MS
5.	Co 0238	LS	LS	MS	LS
6.	CoS 12232	LS	LS	MS	MS
7.	Co 12029	LS	LS	MS	MS
8.	CoH 12263	LS	LS	MS	HS
9.	CoLk 12205	LS	LS	MS	LS
10.	CoPant 12226	LS	LS	HS	MS
11.	Co 05011	LS	LS	MS	LS
12.	CoPb 12211	LS	LS	MS	LS

4. Shahjahanpur

AVT (Midlate)-I Plant					**AVT (Midlate)-II Plant**			
Sl.No.	Variety/Genotypes	ESB	TB	StB	Variety/Genotypes	ESB	TB	StB
1.	CoPb 13182	LS	LS	LS	CoPant12226	LS	LS	LS
2.	Co Pant13224	MS	LS	MS	CoLk 12205	LS	MS	MS
3.	CoH 13263	LS	LS	LS	CoH 12263	LS	MS	MS
4.	Co 13035	LS	MS	LS	Co 12029	MS	MS	LS

5.	CoLk 13204	LS	LS	HS	CoPb 12211	LS	LS	MS
	Co 05011	LS	LS	MS	CoS 12232	LS	LS	LS
	CoS 767	LS	LS	LS	CoS 8436 (CK)	LS	LS	LS
	CoS 8436	LS	MS	MS	CoS 767(CK)	LS	LS	LS
CK	CoPant 97222	LS	LS	LS	CoPant 97222(CK)	LS	LS	MS
AVT (Early)-I Plant					**AVT (Early)-II Plant**			
1.	CoS 13231	LS	LS	LS	CoPant 12221	LS	MS	MS
2.	CoPb 13181	LS	LS	LS	CoLk 12203	LS	LS	MS
3.	Co 13034	LS	LS	LS	Co 12027	LS	LS	LS
4.	Co 05009	LS	MS	LS	Co12026	LS	LS	LS
CK	CoJ 64	MS	MS	LS	CoJ 64 (CK)	LS	LS	LS
	Co 0238	LS	MS	MS	Co 0238 (CK)	LS	MS	LS
AVT (Midlate)-Ratoon					**AVT (Early)-Ratoon**			
1.	Co 12029	LS	HS	LS	Co 12026	LS	LS	LS
2.	CoH 12263	LS	HS	MS	Co 12027	LS	LS	LS
3.	CoLk 12205	LS	HS	MS	CoLk 12203	LS	LS	MS
4.	CoPant 12226	LS	HS	LS	CoPant 12221	LS	LS	MS
5.	CoPb 12211	LS	HS	LS	CoJ 64 (CK)	LS	LS	LS
6.	CoS 12232	LS	HS	MS	Co 0238 (CK)	LS	LS	MS
	CoS 8436	LS	HS	MS				
	CoS 767	LS	HS	LS				
CK	Co Pant 97222	LS	HS	MS				

5. Lucknow

AVT (Early)-I Plant						**AVT (Midlate)-I Plant**				
Sl. No.	Varieties / Genotypes	TB		INB	StB	Varieties / Genotypes	TB		INB	StB
		III	IV				III	IV	LS	LS
1.	CoLk 12203	MS	MS	LS	HS	CoS 767	MS	MS	LS	LS
2.	Co 12027	HS	HS	LS	HS	CoLk 12205	MS	MS	LS	LS
3.	CoS 13231	MS	MS	LS	HS	CoPant 12226	MS	HS	LS	LS
4.	Co 0238	MS	HS	LS	HS	CoS 12232	LS	MS	LS	LS
5.	CoPant 2227	MS	MS	LS	MS	Co 13035	MS	HS	LS	LS
6.	CoJ 64	MS	MS	LS	MS	CoLk 13204	MS	HS	LS	LS
7.	-	-	-	-	-	CoPant 13224	MS	HS	LS	LS
8.	-	-	-	-	-	CoPb 13182	MS	HS	LS	LS
9.	-	-	-	-	-	CoS 8436	MS	HS	LS	LS
10.	-	-	-	-	-	CoLk 13263	MS	HS	LS	LS
11.	-	-	-	-	-	Co 05011	MS	LS	LS	LS
12.	-	-	-	-	-	Co Pb 12211	MS	MS	LS	LS
13.	-	-	-	-	-	CoPant 97222	MS	HS	LS	LS
14.	-	-	-	-	-	Co12263	MS	MS	LS	LS
15.	-	-	-	-	-	Co12029	MS	HS	LS	LS

North Central & North Eastern Zones

1. Pusa

Forty genotypes i.e. eleven in IVT Early, six in AVT Early I-Plant, twelve in IVT Mid late, six in AVT Mid late II-Plant, and five AVT Early II Plant including standard check were evaluated against root, shoot, top and stalk borer.

The cumulative incidence of early shoot borer was recorded as lowest (6.60%) in variety CoSe 01421 AVT E IP and highest (16.50%) in variety CoLK 12209 AVT M IIP. The genotypes tested under different maturity groups are graded under less to moderately susceptible reaction against early shoot borer. While, incidence of root borer was found minimum (6.80%) in variety CoSe 14451 IVT E and maximum (9.75%) in variety CoLK 94184 AVT E IP graded as less susceptible reaction. The incidence of top borer was recorded as less to moderate being 7.00% in variety CoP 06436 IVT M and 12.00% in variety CoP 14436 IVT E against 4th brood of top borer.

2. Seorahi

AVT (MID-LATE) 2nd PLANT

In AVT (Mid-late) I- plant, total four varieties viz., CoLk 09204, CoLk 12209, CoP 12438 and CoSe 12453 were evaluated along with two standards (checks) BO 91 and CoP 9301 against shoot, top, stalk and root borers. All the varieties including standard showed less susceptible reaction to shoot borer, top borer, stalk borer and root borer.

AVT (EARLY) I PLANT

Under AVT (Early) I plant, three varieties were evaluated viz., CoP 13437, CoSe 13451, CoSe 13452 alongwith three standard varieties CoLk 94184, CoSe 01421 and CoSe 95422 against shoot, top, root and stalk borer.

AVT (EARLY) II PLANT

Under AVT (Early) II plant, three varieties were evaluated viz., CoLk 12207, CoP 12436 and CoSe 12451 alongwith two standard varieties BO 130 and CoSe 95422 against shoot, top, stalk and root borer.

North Central & North Eastern Zones

1. Pusa

IVT (Early)						**AVT (Early)-I Plant**				
Sl. No.	Varieties / Genotypes	ESB	TB	StB	RB	Varieties / Genotypes	ESB	TB	StB	RB
1	CoP 14436	LS	MS	LS	LS	CoSe 13452	LS	LS	LS	LS
2	CoP 14437	LS	LS	LS	LS	CoP 13437	MS	MS	LS	LS
3	CoSe 14451	LS	LS	LS	LS	CoSe 13451	LS	LS	LS	LS
4	CoSe 14453	MS	LS	LS	LS	CoLk 94184 (CK.)	LS	LS	LS	LS
5	CoSe 14454	LS	MS	LS	LS	CoSe 95422 (CK.)	MS	LS	LS	LS
6	CoLK 14206	MS	LS	LS	LS	CoSe 01421 (CK)	LS	LS	LS	LS
7	CoLK 14207	LS	LS	LS	LS	-	-	-	-	-
8	CoBLN14501	LS	LS	LS	LS	-	-	-	-	-
CK	CoSe 01421	LS	LS	LS	LS	-	-	-	-	-
	CoLK 94184	LS	LS	LS	LS	-	-	-	-	-
	CoSe 95422	MS	MS	LS	LS	-	-	-	-	-
IVT (Midlate)						**AVT (Midlate)-II Plant**				
1	CoP 14438	LS	LS	LS	LS	CoP 12438	LS	LS	LS	LS
2	CoP 14439	LS	LS	LS	LS	CoSe 12453	LS	MS	LS	LS
3	CoSe 14452	LS	LS	LS	LS	COLK 12209	MS	LS	LS	LS
4	CoSe 14455	MS	LS	LS	LS	COLK 09204	LS	MS	LS	LS
5	CoSe 14456	LS	LS	LS	LS	BO 91 (CK)	LS	LS	LS	LS
6	COBLN 14502	MS	MS	LS	LS	CoP 9301 (CK)	LS	LS	LS	LS
7	COLK 14208	LS	LS	LS	LS	-	-	-	-	-
8	COLK 14209	LS	LS	LS	LS	-	-	-	-	-
9	COLK 14210	LS	LS	LS	LS	-	-	-	-	-
CK	CoP 06436	LS	LS	LS	LS	-	-	-	-	-
	BO 91	LS	LS	LS	LS	-	-	-	-	-
	CoP 9301	LS	MS	LS	LS	-	-	-	-	-
AVT (Early)-II Plant										
1	CoP 12436	LS	LS	LS	LS	-	-	-	-	-
2	COLK 12207	LS	MS	LS	LS	-	-	-	-	-
3	CoSe 12451	MS	LS	LS	LS	-	-	-	-	-
CK	BO 130	LS	LS	LS	LS	-	-	-	-	-
	CoSe 95422	MS	LS	LS	LS	-	-	-	-	-

2. Seorahi

AVT (Midlate)-II Plant						AVT (Early)-I Plant				
Sl. No.	Varieties / Genotypes	ESB	TB	StB	RB	Varieties / Genotypes	ESB	TB	StB	RB
1	Co lk 09204	LS	LS	LS	LS	CoP 13437	LS	MS	LS	LS
2	Colk 12209	LS	LS	LS	LS	CoSe 13451	LS	LS	LS	LS
3	CoP12438	LS	LS	LS	LS	CoSe13452	LS	LS	LS	LS
4	CoSe 12453	LS	LS	LS	LS	CoSe 01421(CK)	LS	LS	LS	LS
(CK)	BO91	LS	LS	LS	LS	CoLk 94184(CK)	LS	LS	LS	LS
	CoP9301	LS	LS	LS	LS	CoSe 95422(CK)	LS	MS	LS	LS
AVT (Early)-II Plant										
1	CoLk 12207	LS	MS	LS	LS	-	-	-	-	-
2	CoP 12436	LS	MS	LS	LS	-	-	-	-	-
3	CoSe 12451	LS	MS	LS	LS	-	-	-	-	-
	BO130	LS	MS	LS	LS	-	-	-	-	-
CK	CoSe 95422	LS	MS	LS	LS	-	-	-	-	-

Peninsular Zone

1. Akola

In IVT Early, total forty genotypes and three standard checks (CoC 671, Co 86032, CoSnk 05103) early shoot borer, Scale insect and Pyrilla. After 30 days after (DAP), only two genotypes viz., CoT 14367 and Co 13022 were MS to early shoot borer while at 60 DAP, 90 DAP and 120 DAP all genotypes including standard checks were less susceptible. Genotypes viz., Co 12007, Co 12008, CoC 671, CoSnk 05103 and VSI 12121 were MS and remaining genotypes were highly susceptible. All genotypes were LS to Pyrilla.

In AVT Early I Plant, total eleven genotypes including three standard checks were evaluated against early shoot borer, scale insect and Pyrilla. At 30 DAP, six genotypes viz., Co 12007, CoC 671, CoSnk 05103, Co 12009, Co 12019, CoM 12085 and VSI 12121 were MS to early shoot borer while at 60 DAP only Co 12019 was MS and at 120 DAP all genotypes were LS to early shoot borer. Co12007, Co 12008, CoC 671, CoSnk 05103, and VSI 12121 were MS and rests of genotypes were HS to scale insect. All genotypes were LS to Pyrilla.

In AVT Early II Plant eight genotypes including standard checks were evaluated against early shoot borer, scale insect and Pyrilla. Only three genotypes viz., CoM 12085, Co 11004, CoM 11082 were MS and rests of genotypes were LS to early shoot borer at 30 DAP and subsequently at 120 DAP all genotypes were LS to ESB. Four genotypes viz., CoM 11081, CoM 11084, Co 11004 and CoM 11082 were MS and rests of the genotypes were HS to scale insect. All genotypes were LS to Pyrilla.

In AVT Early Ratoon, eight genotypes including standard checks were evaluated against early shoot borer, scale insect and Pyrilla. Two genotypes Co 1101 and Co 94008 were to early shoot borer and rests of the genotypes were LS at 30 DAP and all the genotypes showed LS reaction at 60, 90 and 120 DAP. Only one genotype, Co 04008 was MS and rests of the genotypes were HS to scale insect. All genotypes were LS to Pyrilla.

In AVT Mid late II Plant all eight genotypes showed LS reaction against early shoot borer and *Pyrilla perpusilla*. Co 11005, Co 11019, CoM 11086 and Co 11012 were MS and rests of the genotypes were HS to scale insect.

In AVT Mid late-Ratoon, all genotypes were LS to early shoot borer, *Pyrilla perpusilla* and HS to scale insect .

2. Padegaon

In IVT (Early), out of 40 genotypes, CoN 14071, CoSnk 14101, MS 140082 and PI 14132 were LS to early shoot borer, twelve genotypes HS and rest twenty four genotypes were MS to early shoot borer. Out of 40 genotypes 9, 21, and 10 genotypes were HS, MS and LS, respectively to internode borer. All the genotypes were HS to mealy bug and 7, 20 and 13 genotypes were HS, MS and LS to scale insect, respectively.

In IVT (Early) I Plant Out of eleven genotypes only standard check CoSnk 05103 was LS and rest of the genotypes were MS to early shoot borer. Four genotypes viz., Co 12007, Co 12008, CoM 12085 and CoC 671 were LS while two genotypes, Co 12009 and Co 12012 were HS to internode borer. All genotypes were HS to mealy bug. Five genotypes viz., Co 12008, CoM 1285, VSI 12121 were LS and rests of the genotypes were MS to scale insect.

In AVT (Early) II Plant except one standard check CoC 671 all genotypes were LS to early shoot borer. Both standard checks and two genotypes, Co 11001 and CoM 11081 were HS to internode borer and only two genotypes CoM 11086 and Co 85004 were LS.

Except CoM 11084 (MS) all other genotypes were HS to mealy bug. Only two genotypes including one standard CoC671 and Co11001 were MS and rests of the genotypes LS to scale insect.

In AVT (Midlate) II Plant, four genotypes viz., Co 11007, Co 11012, Co 11019 and Co 99004 were LS and other genotypes were MS to early shoot borer. All the genotypes were HS to mealy bug. Only three genotypes viz. Co 11007, Co 11012 and CoM 11086 were MS and rests of the genotypes were LS to scale insects.

In AVT (Early) Ratoon, only one genotype, Co 11004 was LS and rests of the genotypes were MS to early shoot borer. One genotype, Co 94008 was MS and rests of the genotypes were LS to INB. Except one genotype Co 94008 all genotypes were rated as HS to Scale insect.

In AVT (Mid late) Ratoon, all eight genotypes were LS to early shoot borer. In case of internode borer, three genotypes viz., Co 11012, Co 11019 and CoM 11086 were LS and rest of the genotypes showed MS reaction. All the genotypes were HS to mealy bug. Out of eight genotypes, Co 86032 was LS while Co 11005 and Co 11007 were MS to Scale insects and rest of the genotypes were HS.

3. Pune

In IVT, Co 14032, CoT 14367, Co 86032, Co 14004 and CoN 14072 showed highly susceptible reaction to early shoot borer. All varieties/ genotypes showed less susceptible reaction to internode borer and mealy bug.

In AVT I Plant, out of eleven varieties/genotypes screened Co 12008 and CoSnk 05103 showed less susceptible reaction to early shoot borer. All genotypes showed less susceptible reaction to internode borer, mealy bug and scale insect.

In AVT-II Plant, out of eight genotypes, CoM 11082, CoM 11084 and Co 85004 showed less susceptible reaction to early shoot borer, while all genotypes showed less susceptible reaction to internode borer and scale insect. Co 11001 and CoC 671 showed moderately susceptible reaction to mealy bug.

In AVT Early Ratoon, out of eight genotypes, Co 11004, CoM 11081 and Co 11001 showed moderately susceptible reaction to early shoot borer. All genotypes are less susceptible to internode borer. CoM 11082 and Co 85004 are less susceptible to mealy bug. All genotypes are less susceptible to scale insect except Co 11001 which is moderately susceptible.

In AVT Midlate II plant, out of eight genotypes, Co 11012 and CoM 11085 showed moderately susceptible reaction to mealy bug. All genotypes showed less susceptible reaction to early shoot borer, internode borer and scale insect.

In AVT Midlate Ratoon, out of eight genotypes were found less susceptible to early shoot borer and internode borer. Co 86032 and Co 99004 showed less susceptible reaction to mealy bug. CoM 11086 was found moderately susceptible to scale insect.

4. Powarkheda

AVT - II (Early)

All the check as well as entries graded as moderately susceptible (MS) against early shoot borer.

AVT - II (mid late group)

The CoM 11086 and Co 11019 graded as least susceptible (LS), while all other including check varieties graded as MS to early shoot borer.

AVT – I (Plant) 2017-18

Out of total screened entries, six graded as least susceptible (LS), while two entries and both check varieties graded as MS.

IVT (Plant) 2018-19

Thirty two entries graded as least susceptible (LS), whereas sixteen entries and both check varieties graded as moderately susceptible (MS).

5. Navsari

In IVT

Out of 40 genotypes only one genotype, PI 14131 was MS and rests of the genotypes were found LS to early shoot borer. All the genotypes were LS to top borer.

In AVT (E) I-Plant

Out of elven genotypes, CoM 12085, VS I12121, Co 86032 were MS and rests of the genotypes were found LS to early shoot borer. All the genotypes were LS to top borer. Only one genotype, Co 12008 was HS and rests of the genotypes were MS to root borer.

In AVT (E) II-Plant

All genotypes were LS to early shoot borer, top borer and mealy bug while MS to root borer.

In AVT (Midlate) II-Plant

Three genotypes viz., Co 11005, Co 11019 and Co 99004 were MS and rests of the genotypes were LS to early shoot borer. All genotypes were LS to top borer and mealy bug while one genotype, CoM 11086 was HS and rests of the genotypes were LS to root borer.

6. Mandya

In IVT, out of fourty genotypes, Co 13021, Co 14032, CoVC 14061, CoVC 14062, CoT 14367,and MS 14002

were LS to early shoot borer. Co 14008, Co 14009, Co 14023, Co 14025, Co 14026, Co 14031CoN 14073, CoN 14074, CoVC 14062, VSI 14121, VSI 14122, Co 14006, CoN14072 and CoSnk14101 were MS and rests of the genotypes were LS to Top Borer. Co 13021, C 14009, Co 14012, Co 14023, Co 14032, CoN 14073, Co 14074, CoVC 14062, Co 14002, Co 14006, CoT 14367 and Co 14082 were LS to INB and rests of the genotypes were MS. Co 13021, Co 14032, CoVC 14062, CoT 14366 and MS 14082 were LS to ESB, TSB and INB.

In AVT I Plant, out of eleven genotypes including standard checks, Co 12007, Co 12009, CoM 12085, and VSI 12121 were LS to early shoot borer, top borer and internode borer.

In AVT early II Plant, out of eight genotypes including standard checks only two genotypes viz., CoM 11082 and Co 11004 were LS to early shoot borer, top borer and internode borer.

In AVT Midlate II Plant, out of eight genotypes including standard checks were LS to internode borer. Co 11005, Co 11007, Co 11019, Co 11085, CoM 11086 were LS to early shoot borer. In case of top borer, only two genotypes viz., Co 11005 and Co 11019 were MS and rests of the genotypes were LS.

7. Kolhapur

Not conducted

8. Coimbatore

In IVT (Early), out of therty seven genotypes, only one genotype CoN 14072 showed LS reaction to early shoot borer whereas fourteen genotypes were MS and rests twenty two genotypes were HS to ESB. All genotypes were HS to Intenode borer and LS to top borer.

In AVT (early) I Plant, out of four genotypes Co 12012 and Co 86032 were HS and Co 12007 and CoC 671 were MS to early shoot borer and HS to internode borer.

In AVT (early) II- Plant, all eight genotypes including standard checks were HS to internode borer and LS to top borer. Standard check CoC 671 was MS and rests of the genotypes were found HS to early shoot borer.

In AVT Midlate II Plant, two genotypes, CoM 11085 and Co 86032 were HS and rests of the genotypes were MS to early shoot borer and LS to top borer. All genotypes were HS to internode borer.

In AVT Ratoon, All genotypes were HS to internode borer.

Peninsular Zone

1. Akola

IVT (Early)-Plant

Sl.No.	Varieties / Genotypes	ESB				Scale insect	Pyrilla
		30DAP	60DAP	90DAP	120DAP		
1	Co14032	LS	LS	LS	LS	HS	LS
2	CoC671	LS	LS	LS	LS	HS	LS
3	CoT14367	MS	LS	LS	LS	HS	LS
4	CoVc14062	LS	LS	LS	LS	HS	LS
5	Co14025	LS	LS	LS	LS	HS	LS
6	CoT14112	LS	LS	LS	LS	HS	LS
7	Co14006	LS	LS	LS	LS	HS	LS
8.	CoN14071	LS	LS	LS	LS	HS	LS
9.	Co14016	LS	LS	LS	LS	HS	LS
10.	Co14008	LS	LS	LS	LS	HS	LS
11.	CoSnk14102	LS	LS	LS	LS	HS	LS
12.	Co86032	LS	LS	LS	LS	HS	LS
13.	Co13022	MS	LS	LS	LS	MS	LS
14.	VSI14121	LS	LS	LS	LS	HS	LS
15.	Co14030	LS	LS	LS	LS	HS	LS
16.	Co14031	LS	LS	LS	LS	MS	LS
17.	Co14012	LS	LS	LS	LS	HS	LS
18.	Co14004	LS	LS	LS	LS	MS	LS
19.	CoT14111	LS	LS	LS	LS	HS	LS
20.	CoT14366	LS	LS	LS	LS	HS	LS
21.	CoN14073	LS	LS	LS	LS	HS	LS

22.	CoN14072	LS	LS	LS	LS	HS	LS
23.	CoVc14061	LS	LS	LS	LS	HS	LS
24.	MS14081	LS	LS	LS	LS	HS	LS
25.	Co14022	LS	LS	LS	LS	HS	LS
26.	Co14026	LS	LS	LS	LS	HS	LS
27.	CoSnk05103	LS	LS	LS	LS	HS	LS
28.	Co14009	LS	LS	LS	LS	HS	LS
29.	Co14002	LS	LS	LS	LS	HS	LS
30.	PI14131	LS	LS	LS	LS	MS	LS
31.	Co14023	LS	LS	LS	LS	HS	LS
32.	Co14003	LS	LS	LS	LS	HS	LS
33.	CoN14074	LS	LS	LS	LS	MS	LS
34.	MS14082	LS	LS	LS	LS	HS	LS
35.	Co13021	LS	LS	LS	LS	HS	LS
36.	PI14132	LS	LS	LS	LS	MS	LS
37.	CoSnk14101	LS	LS	LS	LS	HS	LS
38.	CoSnk14103	LS	LS	LS	LS	HS	LS
39.	VSI14122	LS	LS	LS	LS	HS	LS
40.	Co14027	LS	LS	LS	LS	MS	LS
AVT (Early)- I Plant							
1	Co12007	MS	LS	LS	LS	MS	LS
2	Co86032	LS	LS	LS	LS	HS	LS
3	Co12008	LS	LS	LS	LS	MS	LS
4	CoC671	MS	LS	LS	LS	MS	LS
5	Co12009	MS	LS	LS	LS	HS	LS
6	CoSnk05103	LS	LS	LS	LS	MS	LS
7	Co12012	LS	LS	LS	LS	HS	LS
8.	Co12019	MS	MS	LS	LS	HS	LS
9.	Co12024	LS	LS	LS	LS	HS	LS
10.	CoM12085	MS	LS	LS	LS	HS	LS
11.	VSI12121	MS	LS	LS	LS	MS	LS
AVT (Early)- II Plant							
1	Co11001	LS	LS	LS	LS	HS	LS
2	Co85004	LS	LS	LS	LS	HS	LS
3	CoM11081	MS	LS	LS	LS	MS	LS
4	Co94008	LS	LS	LS	LS	HS	LS
5	CoM11084	LS	LS	LS	LS	MS	LS
6	Co11004	MS	LS	LS	LS	MS	LS
7	CoM11082	MS	LS	LS	LS	MS	LS
8.	CoC671	LS	LS	LS	LS	HS	LS
AVT (Early)- Ratoon							
1	Co11001	MS	LS	LS	LS	HS	LS
2	Co11004	LS	LS	LS	LS	HS	LS
3	CoM11081	LS	LS	LS	LS	HS	LS
4	CoM11082	LS	LS	LS	LS	HS	LS
5	CoM11084	LS	LS	LS	LS	HS	LS
6	Co85004	LS	LS	LS	LS	HS	LS
7	Co94008	MS	LS	LS	LS	MS	LS
8.	CoC671	LS	LS	LS	LS	HS	LS
AVT (Midlate)-II Plant							
1	Co11005	LS	LS	LS	LS	MS	LS
2	Co11007	LS	LS	LS	LS	HS	LS
3	Co86032	LS	LS	LS	LS	HS	LS

4	Co11019	LS	LS	LS	LS	MS	LS
5	CoM11085	LS	LS	LS	LS	HS	LS
6	CoM11086	LS	LS	LS	LS	MS	LS
7	Co11012	LS	LS	LS	LS	MS	LS
8.	Co99004	LS	LS	LS	LS	HS	LS
AVT (Midlate)-Ratoon							
1	Co11005	LS	LS	LS	LS	HS	LS
2	Co11007	LS	LS	LS	LS	HS	LS
3	Co11012	LS	LS	LS	LS	HS	LS
4	Co11019	LS	LS	LS	LS	HS	LS
5	CoM11085	LS	LS	LS	LS	HS	LS
6	CoM11086	LS	LS	LS	LS	HS	LS
7	Co86032	LS	LS	LS	LS	HS	LS
8.	Co99004	LS	LS	LS	LS	HS	LS

2. Paedegaon

IVT (Early)						**AVT (Early)- I Plant**				
Sl. No.	Varieties / Genotypes	ESB	INB	Mealy bug	Scale insect	Varieties / Genotypes	ESB	INB	Mealy bug	Scale insect
1	Co 14002	MS	HS	HS	LS	Co 12007	MS	HS	HS	LS
2	Co 14003	MS	HS	HS	LS	Co 12008	MS	HS	HS	LS
3	Co 14004	HS	HS	HS	MS	Co 12009	MS	LS	HS	MS
4	Co 14006	MS	HS	HS	HS	Co 12012	MS	LS	HS	MS
5	CoN 14071	LS	MS	HS	LS	Co 12019	MS	MS	HS	MS
6	CoN14072	MS	MS	HS	LS	Co 12024	MS	MS	HS	MS
7	CoSnk 14101	LS	LS	HS	HS	CoM 12085	MS	HS	HS	LS
8	CoSnk 14102	MS	LS	HS	HS	VSI 12121	MS	MS	HS	LS
9	CoT 14366	HS	MS	HS	MS	Co 86032	MS	MS	HS	MS
10	CoT 14367	HS	MS	HS	MS	CoC 671	MS	HS	HS	LS
11	MS 14081	MS	MS	HS	MS	CoSnk 05103	LS	MS	HS	MS
12	MS 14082	LS	MS	HS	MS	-	-	-	-	-
13	Co 13021	MS	MS	HS	HS	-	-	-	-	-
14	Co 13022	MS	MS	HS	MS	-	-	-	-	-
15	Co 14008	HS	MS	HS	MS	-	-	-	-	-
16	Co 14009	HS	HS	HS	HS	-	-	-	-	-
17	Co 14012	HS	MS	HS	LS	-	-	-	-	-
18	Co 14016	MS	LS	HS	LS	-	-	-	-	-
19	Co 14022	MS	HS	HS	MS	-	-	-	-	-
20	Co 14023	MS	HS	HS	LS	-	-	-	-	-
21	Co 14025	MS	MS	HS	MS	-	-	-	-	-
22	Co 14026	MS	LS	HS	LS	-	-	-	-	-
23	Co 14027	HS	MS	HS	MS	-	-	-	-	-
24	Co 14030	HS	LS	HS	MS	-	-	-	-	-
25	Co 14031	MS	LS	HS	MS	-	-	-	-	-
26	Co 14032	HS	MS	HS	MS	-	-	-	-	-
27	CoN 14073	HS	HS	HS	HS	-	-	-	-	-
28	CoN 14074	HS	LS	HS	LS	-	-	-	-	-
29	CoSnk 14103	MS	MS	HS	MS	-	-	-	-	-
30	CoTl14111	MS	LS	HS	LS	-	-	-	-	-
31	CoTl 14112	MS	MS	HS	MS	-	-	-	-	-
32	CoVC14061	MS	MS	HS	MS	-	-	-	-	-
33	CoVC 14062	MS	MS	HS	LS	-	-	-	-	-
34	PI 14131	MS	MS	HS	MS	-	-	-	-	-

35	PI 14132	LS	MS	HS	HS	-	-	-	-	-
36	VSI 14121	MS	HS	HS	MS	-	-	-	-	-
37	VSI 14122	MS	LS	HS	LS	-	-	-	-	-
38	Co 86032	HS	MS	HS	MS	-	-	-	-	-
39	CoC 671	MS	MS	HS	HS	-	-	-	-	-
40	CoSnk 05103	MS	LS	HS	MS	-	-	-	-	-
AVT (Early)- II Plant						**AVT (Midlate)- II Plant**				
1	Co 11001	LS	HS	HS	MS	Co 11005	MS	HS	HS	LS
2	Co 11004	LS	MS	HS	LS	Co 11007	LS	MS	HS	MS
3	CoM 11081	LS	HS	HS	LS	Co 11012	LS	LS	HS	MS
4	CoM 11082	LS	MS	HS	LS	Co 11019	LS	MS	HS	LS
5	CoM 11084	LS	LS	MS	LS	CoM 11085	MS	MS	HS	LS
6	Co 85004	LS	LS	HS	LS	CoM 11086	MS	HS	HS	MS
7	Co 94008	LS	HS	HS	LS	Co 86032	MS	MS	HS	LS
8	CoC 671	MS	HS	HS	MS	Co 99004	LS	LS	HS	LS
AVT (Early)- Ratoon						**AVT (Midlate) Ratoon**				
1	Co 11001	MS	LS	HS	HS	Co 11005	LS	MS	HS	MS
2	Co 11004	LS	LS	HS	HS	Co 11007	LS	MS	HS	MS
3	CoM 11081	MS	LS	HS	HS	Co 11012	LS	LS	HS	HS
4	CoM 11082	MS	LS	HS	HS	Co 11019	LS	LS	HS	HS
5	CoM 11084	MS	LS	HS	HS	CoM 11085	LS	MS	HS	HS
6	Co 85004	MS	LS	HS	HS	CoM 11086	LS	LS	HS	HS
7	Co 94008	MS	MS	HS	MS	Co 86032	LS	MS	HS	LS
8	CoC 671	MS	LS	HS	LS	Co 99004	LS	MS	HS	HS

3. Pune

IVT Early/ Midlate					**AVT (Early/Midlate)-I Plant**				
Sl.No.	Varieties / Genotypes	ESB*	INB	Mealy bug	Varieties / Genotypes	ESB	INB	Mealy bug	Scale insect
1	*Co 14002*	LS	LS	LS	*Co 12007*	MS	LS	LS	LS
2	Co 14003	LS	LS	LS	Co 12008	LS	LS	LS	LS
3	Co14004	HS	LS	LS	Co 12009	MS	LS	LS	LS
4	Co 14006	MS	LS	LS	Co 12012	HS	LS	LS	LS
5	CoN 14071	MS	LS	LS	Co 12019	HS	LS	LS	LS
6	CoN 14072	HS	LS	LS	Co 12024	MS	LS	LS	LS
7	CoSnk 14101	LS	LS	LS	CoM 12085	HS	LS	LS	LS
8.	CoSnk 14102	MS	LS	LS	VSI 12121	MS	LS	LS	LS
9.	CoT 14366	MS	LS	LS	Co 86032 (CK)	HS	LS	LS	LS
10.	CoT 14367	HS	LS	LS	CoC 671 (CK)	MS	LS	LS	LS
11.	MS 14081	LS	LS	LS	CoSnk 05103 (CK)	LS	LS	LS	LS
12.	MS 14082	MS	LS	LS	-	-	-	-	-
13.	Co 13021	LS	LS	LS	-	-	-	-	-
14.	Co 13022	MS	LS	LS	-	-	-	-	-
15.	Co 14008	MS	LS	LS	-	-	-	-	-
16.	Co 14009	MS	LS	LS	-	-	-	-	-
17.	Co 14012	MS	LS	LS	-	-	-	-	-
18.	Co 14016	MS	LS	LS	-	-	-	-	-
19.	Co 14022	MS	LS	LS	-	-	-	-	-
20.	Co 14023	MS	LS	LS	-	-	-	-	-
21.	Co 14025	MS	LS	LS	-	-	-	-	-
22.	Co 14026	MS	LS	LS	-	-	-	-	-
23.	Co 14027	MS	LS	LS	-	-	-	-	-
24.	Co 14030	MS	LS	LS	-	-	-	-	-
25.	Co 14031	LS	LS	LS	-	-	-	-	-

26.	Co 14032	HS	LS	LS	-	-	-	-	-
27.	CoN 14073	MS	LS	LS	-	-	-	-	-
28.	Co N 14074	MS	LS	LS	-	-	-	-	-
29.	CoSnk 14103	MS	LS	LS	-	-	-	-	-
30.	CoTL 14111	LS	LS	LS	-	-	-	-	-
31.	CoTL 14122	MS	LS	LS	-	-	-	-	-
32.	CoVC 14061	MS	LS	LS	-	-	-	-	-
33.	CoVC 14062	MS	LS	LS	-	-	-	-	-
34.	PI 14131	LS	LS	LS	-	-	-	-	-
35.	PI 14132	LS	LS	LS	-	-	-	-	-
36.	VSI 14121	LS	LS	LS	-	-	-	-	-
37.	VSI 14122	MS	LS	LS	-	-	-	-	-
CK	CoC 671	LS	LS	LS	-	-	-	-	-
	Co 86032	HS	LS	LS	-	-	-	-	-
	Co Snk 05103	MS	LS	LS	-	-	-	-	-

AVT (Early)-II Plant						**AVT (Early)-Pooled**				
Sl.No.	Varieties / Genotypes	ESB*	INB	Mealy bug	Scale insect	Varieties / Genotypes	ESB*	INB	Mealy bug	Scale insect
1	Co 11001	LS	LS	LS	LS	Co 11001	MS	LS	MS	LS
2	Co 11004	LS	LS	LS	LS	Co 11004	MS	LS	LS	LS
3	CoM 11081	LS	LS	LS	LS	CoM 11081	MS	LS	LS	LS
4	CoM 11082	LS	LS	LS	LS	CoM 11082	LS	LS	LS	LS
5	CoM 11084	LS	LS	LS	LS	CoM 11084	LS	LS	LS	LS
CK	Co 85004	LS	LS	LS	LS	Co 85004	LS	LS	LS	LS
	Co 94008	LS	LS	LS	LS	Co 94008	MS	LS	LS	LS
	CoC 671	HS	LS	LS	LS	CoC 671	MS	LS	MS	LS
AVT (Early)-Ratoon										
1	Co 11001	MS	LS	MS	MS	-	-	-	-	
2	Co 11004	MS	LS	MS	LS	-	-	-	-	
3	CoM 11081	MS	LS	MS	LS	-	-	-	-	
4	CoM 11082	LS	LS	LS	LS	-	-	-	-	
5	CoM 11084	LS	LS	MS	LS	-	-	-	-	
CK	Co 85004	LS	LS	LS	LS	-	-	-	-	
	Co 94008	LS	LS	MS	LS	-	-	-	-	
	CoC 671	LS	LS	MS	LS	-	-	-	-	

4. Powerkhera

AVT (Early)-I Plant			**AVT (Early)-II Plant**		**AVT (Midlate)-II Plant**	
Sl.No.	Varieties / Genotypes	ESB	Varieties / Genotypes	ESB	Varieties / Genotypes	ESB
1	Co 12024	LS	Co 85004	MS	CoM 11086	LS
2	VSI 12121	LS	CoM 11082	MS	Co 11019	LS
3	Co 12012	LS	Co 11004	MS	Co 86032	MS
4	Co 12007	LS	Co 94008	MS	CoM 11085	MS
5	CoSnK 5103	LS	CoM 11084	MS	Co 11005	MS
6	CoM 12085	LS	CoC 671	MS	Co 99004	MS
7	Co 12019	MS	CoM 11081	MS	Co 11012	MS
8.	Co 86032	MS	Co 11001	MS	Co 11007	MS
9.	CoC 671	MS	-	-	-	-
10.	Co 12008	MS	-	-	-	-
11.	Co 12009	MS	-	-	-	-

IVT (Early)-Plant											
Sl. No.	Varieties / Genotypes	ESB	Sl.No.	Varieties / Genotypes	ESB	Sl. No.	Varieties / Genotypes	ESB	Sl. No.	Varieties / Genotypes	ESB
1	Co 14023	LS	11	Co 14026	LS	21	PI 14131	LS	31	CoSnK 14102	MS
2	Co 14025	LS	12	Co 14022	LS	22	Co 14030	LS	32	CoC 671	MS
3	CoSnK 05103	LS	13	CoVC 14062	LS	23	Co 14012	MS	33	Co 14006	MS
4	Co 14032	LS	14	CoTl 14111	LS	24	Co 86032	MS	34	CoSnK 14103	MS
5	Co 14009	LS	15	Co 13021	LS	25	CoVC 14061	MS	35	CoN 14071	MS
6	CoT 14367	LS	16	PI 14132	LS	26	CoSnK 14101	MS	36	Co 14003	MS
7	Co 14002	LS	17	CoTl 14112	LS	27	Co 14004	MS	37	Co 13022	MS
8.	VSI 14122	LS	18	CoN 14074	LS	28	CoT 14366	MS	38	Co 14016	MS
9.	CoN 14072	LS	19	MS 14081	LS	29	Co 14031	MS	39	MS 14082	MS
10.	CoN 14073	LS	20	VSI 14121	LS	30	Co 14008	MS	40	Co 14027	MS

5. Navsari

IVT						AVT (early)-I Plant				
Sl. No.	Varieties / Genotypes	ESB	TB	RB	Mealy bug	Varieties / Genotypes	ESB	TB	RB	Mealy bug
1	Co 14002	LS	MS	HS	MS	Co 12007	LS	LS	MS	MS
2	Co 14003	LS	LS	MS	-	Co 12008	LS	LS	HS	-
3	Co 14004	LS	LS	MS	MS	Co 12009	LS	LS	MS	MS
4	Co 14006	LS	LS	MS	-	Co 12012	LS	LS	MS	-
5	CoN 14071	LS	LS	MS	MS	Co 12019	LS	LS	MS	-
6	CoN 14072	LS	LS	MS	-	Co 12024	LS	LS	MS	-
7	CoSnk 14101	LS	LS	MS	-	CoM 12085	MS	LS	MS	
8.	CoSnk 14102	LS	LS	MS	MS	VSI 12121	MS	LS	MS	MS
9.	CoT 14366	LS	MS	MS	-	Co 86032	LS	LS	MS	MS
10.	CoT 14367	LS	LS	MS	MS	CoC 671	LS	LS	MS	MS
11.	MS 14081	LS	LS	MS	MS	CoSnk 05103	LS	LS	MS	MS
12.	MS 14082	LS	LS	MS	MS	AVT (early)-II Plant				
13.	Co 13021	LS	LS	MS	MS	Co 11001	LS	LS	MS	LS
14.	Co 13022	LS	LS	MS	MS	Co 11004	LS	LS	MS	-
15.	Co 14008	LS	LS	MS	MS	CoM 11081	LS	LS	MS	MS
16.	Co 14009	LS	LS	MS	MS	CoM 11082	LS	LS	MS	MS
17.	Co 14012	LS	LS	MS	MS	CoM 11084	LS	LS	MS	-
18.	Co 14016	LS	LS	MS	MS	Co 85004	LS	LS	MS	-
19.	Co 14022	LS	LS	MS	MS	Co 94008	LS	LS	MS	MS
20.	Co 14023	LS	LS	MS	MS	CoC 671	LS	LS	MS	-
21.	Co 14025	LS	LS	MS	-	AVT (Midlate)-II Plant				
22.	Co 14026	LS	LS	MS	-	Co 11005	MS	LS	MS	MS
23.	Co 14027	LS	LS	MS	-	Co 11007	LS	LS	MS	MS
24.	Co 14030	LS	LS	MS	-	Co 11012	LS	LS	MS	-
25.	Co 14031	LS	LS	MS	-	Co 11019	MS	-	MS	-
26.	Co 14032	LS	LS	MS	-	CoM 11085	LS	LS	MS	MS
27.	CoN 14073	LS	LS	MS	-	CoM 11086	LS	LS	HS	MS
28.	CoN 14074	LS	LS	MS	-	Co 85004	LS	LS	LS	MS
29.	CoSnk 14103	LS	LS	MS	-	Co 99004	LS	LS	LS	MS
30.	CoTl 14111	MS	LS	MS	-	Co 86032	LS	LS	LS	MS
31.	CoTl 14112	LS	LS	MS	-	-	-	-	-	-
32.	CoVC 14061	LS	LS	MS	-	-	-	-	-	-

33.	CoVC 14062	MS	LS	MS	-	-	-	-	-	-
34.	PI 14131	LS	MS	MS	-	-	-	-	-	-
35.	PI 14132	LS	LS	MS	-	-	-	-	-	-
36.	VSI 14121	LS	LS	MS	-	-	-	-	-	-
37.	VSI 14122	LS	LS	MS	-	-	-	-	-	-
38.	Co 86032	MS	LS	MS	MS	-	-	-	-	-
39.	CoC 671	MS	LS	MS	MS	-	-	-	-	-
40.	CoSnk 05103	MS	LS	MS	MS	-	-	-	-	-

6. Mandya

IVT (Early & Midlate)					**AVT (Early)-I Plant**			
Sl.No.	Genotype	ESB	TB	INB	Genotype	ESB	TB	INB
1	Co 13021	LS	LS	LS	Co 12007	LS	LS	LS
2	Co 13022	MS	LS	MS	Co 12008	MS	LS	MS
3	Co 14008	MS	MS	MS	CoC 671 (Check)	MS	LS	MS
4	Co 14009	MS	MS	LS	CoSnK 05103(Check)	MS	MS	LS
5	Co 14012	MS	LS	LS	Co 12009	LS	LS	LS
6	Co 14016	MS	LS	MS	Co 12012	MS	MS	MS
7	Co 14022	MS	LS	MS	Co 12019	MS	MS	LS
8	Co 14023	MS	MS	LS	Co 12024	MS	LS	MS
9	Co 14025	MS	MS	MS	CoM 12085	LS	LS	LS
10	Co 14026	MS	MS	MS	VSI 12121	LS	LS	LS
11	Co 14027	MS	LS	MS	Co 86032 (Check)	MS	LS	MS
12	Co 14030	MS	LS	MS	AVT (Early) II Plant			
13	Co 14031	MS	MS	MS	Co11001	LS	LS	MS
14	Co 14032	LS	LS	LS	Co11004	LS	LS	LS
15	CoN 14073	MS	MS	LS	CoM11081	MS	MS	MS
16	CoN 14074	MS	MS	LS	CoM11082	LS	LS	LS
17	CoSnk 14103	MS	LS	MS	CoM11084	LS	LS	MS
18	CoTI 14111	MS	LS	MS	CO 85004	LS	MS	LS
19	CoTI 14112	MS	LS	MS	Co94008(Check)	MS	MS	LS
20	CoVC 14061	LS	MS	MS	CoC671 (Check)	MS	LS	MS
21	CoVC 14062	LS	LS	LS	AVT (Midlate)- II Plant			
22	PI 14131	MS	LS	MS	Co11005	LS	MS	LS
23	PI 14132	MS	LS	MS	Co11007	LS	LS	LS
24	VSI 14121	MS	MS	MS	Co11012	MS	LS	LS
25	VSI 14122	MS	LS	MS	Co11019	LS	MS	LS
26	Co86032 (check)	MS	LS	MS	Co11085	LS	LS	LS
27	Co 14002	MS	LS	LS	COM 11086	LS	LS	LS
28	Co 14003	MS	LS	MS	Co86032 (CHECK)	MS	LS	LS
29	Co 14004	MS	LS	MS	Co99004 (CHECK)	MS	LS	LS
30	Co 14006	MS	MS	LS	-	-	-	-
31	CoN 14071	MS	LS	MS	-	-	-	-
32	CoN 14072	MS	MS	MS	-	-	-	-
33	CoSnk14101	MS	LS	MS	-	-	-	-
34	CoSnk14102	MS	MS	MS	-	-	-	-
35	CoT 14366	MS	LS	MS	-	-	-	-
36	CoT 14367	LS	LS	LS	-	-	-	-
37	MS 14081	MS	LS	MS	-	-	-	-
38	MS 14082	LS	LS	LS	-	-	-	-
39	Co Snk 05103 (check)	MS	LS	MS	-	-	-	-
40	CoC 671 (check)	MS	LS	MS	-	-	-	-

7. Coimbatore

IVT (Early)					AVT (Early)-I Plant			
Sl. No.	Genotype	ESB	INB	TB	Genotype	ESB	INB	TB
1	Co13021	HS	HS	LS	Co 12007	MS	HS	-
2	Co14002	MS	HS	LS	Co 12012	HS	HS	-
3	Co14003	HS	HS	LS	Co 86032	HS	-	-
4	Co14004	HS	HS	LS	CoC 671	MS	-	-
5	Co14006	HS	HS	LS	Co 12008	-	HS	-
6	Co14008	HS	HS	LS	Co 12009	-	HS	-
7	Co14009	HS	HS	LS	Co 12019	-	HS	-
8	Co14012	MS	HS	LS	Co 12024	-	HS	-
9	Co14016	HS	HS	LS	CoM 12085	-	HS	
10	Co14022	HS	HS	LS	CoVSI 12121	-	HS	-
11	Co14023	MS	HS	LS	Co 86032	-	HS	-
12	Co14025	MS	HS	LS	CoC 671	-	HS	-
13	Co14026	MS	HS	LS	**AVT (Early)-II Plant**			
14	Co14026	MS	HS	LS	Co 11001	HS	HS	LS
15	Co14027	MS	HS	LS	Co 11004	HS	HS	LS
16	Co14030	HS	HS	LS	CoM 11081	HS	HS	LS
17	Co14031	HS	HS	LS	CoM 11082	HS	HS	LS
18	Co14032	MS	HS	LS	Co 85004	HS	HS	LS
19	CoN14071	HS	HS	LS	Co 94008	HS	HS	LS
20	CoN14072	LS	HS	LS	CoC 671	MS	HS	LS
21	CoN14073	MS	HS	LS	CoM 11084	-	HS	LS
22	CoN14074	HS	HS	LS	**AVT (Midlate)-II Plant**			
23	CoT14111	MS	MS	LS	Co 11005	MS	HS	-
24	CoT 14112	HS	HS	LS	Co 11007	MS	HS	-
25	CoT14367	HS	HS	LS	Co 11012	MS	HS	-
26	CoSnk14102	HS	HS	LS	Co 11019	MS	HS	-
27	CoSnk14103	HS	HS	LS	CoM 11085	HS	HS	-
28	CoSnk14101	HS	HS	LS	Co 86032	HS	HS	-
29	CoVc14061	HS	HS	LS	Co 99004	MS	HS	-
30	CoVc14062	HS	HS	LS	CoM11086	-	HS	-
31	MS 14081	HS	HS	LS	**AVT Ratoon**			
32	MS 14082	HS	HS	LS	Co11004	-	-	HS
33	PI14131	MS	HS	LS	Co 11005	-	-	HS
34	VSI 14121	MS	HS	LS	Co 11007	-	-	HS
35	VSI 14122	MS	HS	LS	Co 11012	-	-	HS
36	CoC671	MS	HS	-	Co 11019	-	-	HS
37	Co86032	HS	HS	-	CoM 11085	-	-	HS
38	Co 13022	-	HS	LS	CoM 11086	-	-	HS
39	Co 86032	-	HS	-	Co 99004	-	-	HS
40	CoC 671	-	HS	-	Co 86032	-	-	HS
41.	CoSnk 05103	-	-	LS	CoC 671	-	-	HS
42.	PI 14132	-	-	LS	Co 85004	-	-	HS

East Cost Zone

1. Anakapalle

Three IVT and nine AVT-I & eight AVT -II entries in comparison with two susceptible checks were field screened against major insect pests in sugarcane.

Among twenty entries, four entries *viz.*, Co V 13 356, Co C 13336, Co A 13322, Co C 13337 showed least susceptible reaction whereas the entries *viz.*, Co C 14337, Co 13029, PI 14377, Co Or 13346, Co C 13339, Co C 14336 and Co A 14321 showed moderate susceptible reaction towards early shoot borer compared to susceptible check, Co A 99082. Remaining all the test entries showed high susceptible reaction towards early shoot borer and the incidence was ranged from 30. 13% DH in Co 13023 to 46.78 % DH in Co A 11326. . The entries *viz*., Co 13028, Co A 12324, PI 15376 recorded moderate incidence of internode borer compared to susceptible checks, Three entries *viz*., Co A 14321, Co V 15356 , PI 14377 , showed least susceptible reaction and found promising against scale insect compared to susceptible checks, Co A 92081 (68.25%) and Co A 99082 (47.89%).

E.28: Survey and surveillance of sugarcane insect pests

North Western Zone

1. Kapurthala

Most of the sugar mill areas surveyed exhibited low insect pest incidence. Early shoot borer, stalk borer, pyrilla and black bug were recorded as major insects, while other, termite, top borer, whitefly, mite & root borer were recorded as minor insect pests in sugarcane.

2. SBI-RC Karnal

Survey was carried out under command areas of seven Co-operative sugar mills of Haryana three sugar mills in Uttar Pradesh. Increase in incidence of pink borer, internode borer and blister mite was observed. In Haryana, incidence of pink borer and internode was 40% and 8.0% and in Uttar Pradesh 30.0% and 5.0 %, repectively. Incidence of blister mite was severe (78.2 % in UP and 62.0% in Haryana).

3. Shahjahanpur

In hot weather, the incidence of early shoot borer was low>5% in Palia, Azabapur and Rosa sugar factory area. The percent incidence of top borer was also low in all surveyed factory areas. The infestation of stalk borer was 7.50% to 11.00%. The infestation of thrips was recorded in some of the factory zones. It's infestation was observed low (7.50%) in Kumbhi to moderate (25.00%, 32.50%) around Rosa and Aira factory zones. Sporadic occurrence of termite, mealy bug, white fly and root borer was found in some factory zones. The infestation of mite was recorded low (7.50%) around Kumbhi, moderate (32.50%) around Khambarkhera and high (65%) around Aira factory zones. Low incidence of Gurdaspur borer was recorded in Rosa, Khambarkhera, Gularia, and Pallia area.

IVT (Early)					**IVT - (Midlate)**			
Sl.No.	Genotype	ESB	INB	Scale insect	Genotype	ESB	INB	Scale insect
1.	Co V 15356	HS	HS	LS	PI 15376	HS	MS	MS
-	-	-	-	-	PI 15377	HS	HS	HS
AVT (Early)- I Plant					**AVT (Midlate)-I Plant**			
1.	Co 13023	HS	HS	LS	Co 13028	HS	MS	MS
2.	Co A 14321	MS	MS	LS	Co 13029	MS	MS	LS
3.	Co C 14336	MS	MS	HS	Co 13031	HS	HS	HS
-	-	-	-	-	Co A 14323	HS	HS	LS
-	-	-	-	-	Co C 14337	MS	HS	HS
-	-	-	-	-	PI 14377	MS	HS	LS
AVT (Early)- II Plant					**AVT(Midlate)- II Plant**			
1.	Co A 13322	HS	HS	HS	Co A 11326	HS	HS	HS
2.	Co C 13336	HS	HS	HS	Co A 12324	HS	MS	HS
3.	Co C 13337	MS	HS	HS	Co C 13339	MS	HS	MS
4.	Co V 13356	MS	HS	HS	Co Or 13346	MS	HS	HS
*CK	Co A 99082	HS	HS	HS	Co A 99082(Ck)	-	HS	HS
	Co A 92081	MS	HS	HS	CO A 92081 (Ck)	-	HS	HS

*CK for all genotypes

4. Lucknow

The survey was conducted in Command area of Chilbaria Sugar Mill, Nanpara Sugar Mill, Bahraich and Hata Sugar Mill, Deoria, U.P. The incidence of root borer and army worm is increasing and incidence was around 5% and 5-10%, respectively with one location a heavy patch incidence of root borer (20%) and army worm (60%) was observed. Incidence of ESB was 5-15%. A black beetle (*Heteronychus* sp.) was observed gnawing the basal portion of young shoots and causing dead heart. Its occurrence was wide spread.

5. Uchani

A roving survey of Mills zones of Cooperative sugar factories viz. Karnal, Yamuna Nagar, Shahabad, Rohtak, Assandh, Panipat, Sonepat and Jind was carried out for insect- pests of sugarcane crop. Survey of insect-pests during pre-monsoon season revealed that in Sugar Mill Zone Karnal a low to moderate (3.5-18.6 % dead heart formation) incidence of pink stem borer, *Sesamia inferens* was observed on varieties Co 89003, Co 0238, Co 0118, Co 05011 and CoH 160 during month of March to first fortnight of April. A moderate incidence of thrips (4.2- 8.5 %), low to high incidence of early shoot borer (3.4-45.6 %) and low incidence of top borer (3-6 %) was observed in plant and ratoon crop in varieties CoJ 85, Co 89003, Co 0238, Co 0118, Co 05011, CoP84212 and CoH 160. Moderate to high incidence of black bug (23-38 bugs/ whorl) was observed in ratoon crop.

North Central & North Eastern Zones

1. Pusa

A survey was conducted in different village of command areas of Majhaulia and Hasanpur sugar factory. The per cent incidence of early shoot borer (5.0 to 11.0%), root borer (2.5 to 4.5%), top borer (10.5 to 15.0 %), stalk borer below 5%, army worm (5.0 to 6.0 %) and pyrilla (8.0 to 12.0) per leaf were observed. The incidence of other pests like mealy bug, termite, grass hopper, scale insect, white fly, etc. were also recorded in traces. Beside, a roving survey was also conducted at sugarcane field in and around Pusa and SRI farm at monthly interval. The per cent incidence of early shoot borer, root borer, top borer plassy borer and stalk borer were varied from 2.0 to 9.0%, 2.0 to 8.0 % and 5.0 to 16.0 % 9.0 to 19.0% and 1.0 to 7.0%, respectively. Pyrilla was observed 5-12 per leaf at Pusa Farm.

2. Seorahi

Survey was carried out in 14 different sugar factory areas viz., Seorahi, Manakapur, Balrampur, Babhanan, Sathiyaon, Dhadha, Ramkola, Goshi, Siswabajar, Khadda, Utrola, Rudhauli Tulshipur, and Partapur for key insect–pests of sugarcane. The incidence of early Shoot borer was >8%. Regarding the sucking pest i.e. thrips population/ leaf was low. The percent incidence of top borer, stalk borer and root borer was low in all surveyed factory zones.

Peninsular Zone

1. Akola

Insect pests survey was carried out at ten locations in Amrawati, Wardha and Yavatmal districts of Maharashtra. Incidence of internode borer ranged from 6 to 16 per cent. Incidence of *Pyrilla perpusilla* 10.0 per cent was observed at five locations. White fly (10%) was noticed at only one location.

2. Padegaon

The cumulative per cent infestation of early shoot borer ranged from 9.21 to 17.77 per cent. The variety Co 86032 showed least incidence of early shoot borer (9.21 %), followed by CoM 11085 (11.69 %) and Co 11019 (13.15 %). Regarding internode borer, the incidence ranged from 6.67 to 40.00 per cent. The entries Co 11012, Co 11019 and CoM 11086 showed least incidence to internode borer (6.67 % each), followed by Co 11005 (23.33 %). The mealy bug incidence ranged from 83.33 to cent per cent. All test genotypes showed highly susceptible reaction to mealy bug. The incidence of scale insect ranged from 3.33 to 70.00 per cent.

3. Pune

Found severe infestation of white fly in Ahmednagar District during July 2017 to August 2017. Severe infestation of white fly and wire worm in A' Nagar district in month of August 2017 was observed. Observed severe infestation of white grub in Solapur and Satara district in the month of September 2017. Recorded severe infestation of internode borer and root borer in Pune district in the month of December 2017.

4. Powarkheda

Among the areas surveyed, highest infestation of early shoot borer as well as pyrilla recorded at Bankhedi sugar factory area. Adsali sugarcane cultivation and trash burning seem to be reason for pyrilla severity. While, plantation of sugarcane mostly in autumn season/ late ratooning is conductive for building-up severe infestation of early shoot borer.

5. Navsari

During the period of survey incidence of borers (early shoot, top borer and root borer) was ranged from 0.81 % to 15 % in Co 86032, Co 86002, Co 97009 (MC 707), CoSi 95071, CoN 05071 and CoM 0265, respectively in South Gujrat. White fly incidence varies from 1.08 to

16.68 % in plant sugarcane. Incidence of mealy bugs found to be infesting 0.69 % in madhi sugar factory area. Rodent damage was reported only 1.57 % in bardoli sugar factory area.

6. Mandya

Eleven insect pests and two species of mites were recorded on sugarcane. Due to dry spell in early part of rainy season and heavy and frequent rainfall in the later part resulted in higher incidence early shoot borer, top shoot borer and internode borer. Army worms moved from paddy to sugarcane fields. An unidentified weevil was also found feeding on the leaves of sugarcane. Incidence of root grubs was more in the area. Due to more frequent rains from August to October, incidence of woolly aphid was also more but the *Dipha* and *Encarcia* appeared in good number and kept the pest under control. Even though Pyrilla leaf hopper, whitefly, leaf weevil and termite appeared in few places they did not reach EIL.

7. Coimbatore

Insect survey was carried out at three locations viz., Teugupalayam, Athipalayam and Annur in Tamilnadu. Incidence of shoot borer, internode borer and top borer ranged from 2.22 to 9.74%, 2.38 to 11.76% and 0.56 to 1.17%, respectively. *Pyrilla perpusilla* was in traces and it was chased by its parasitoid, *Epiricania melanoleuca.*

East Cost Zone

1. Anakapalle

Surveys were conducted in sugarcane fields of Srikakulam, Vizinagaram, Viskhapatnam and East Godavari districts and observed moderate to severe incidence of early shoot borer in Visakhapatnam (12 - 36%), Vizianagaram (26 - 60%), Srikakulam (4 - 28%) and East Godavari (23 - 42%) districts during March to June months. A new species of yellow mealybug, *Kiritshenkella sacchari* (Green) along with pink mealy bug (*Saccharicoccus sacchari* Cockerell) was observed on internodes of 87 A 298 variety in B. Polavaram village of Tuni mandal and incidence was low to medium during April-June. Moderate to severe incidence of internode borer was observed in Visakhapatnam (20-90%), Vizianagaram (20-50%), Srikakulam (30- 70%) and East Godavari (30-90%) districts. Moderate to severe incidence of whitefly (16-39 puparia /sq. inch) was observed. Incidence of sugarcane aphid, *Melanaphis sacchari* was observed on Co V09356 and Co A 92081 varieties (on 90 days old crop) from October to December with peak in November (20-33/leaf).

Insect-pest	Location	Incidence (%)	Varieties	Any other information
1. **Punjab**				
Termite	Faridkot, Fazilka, Ajnala, Nawanshahr	2-3	Co 0238, Co 89003, CoJ 85, CoJ 64, Co 0118	In sandy soil termite attack was more
Early shoot borer	Gurdaspur, Faridkot, Bhogpur, Dasuya, Dhuri, Morinda	5-6	Co 0238, CoJ 88, CoJ 85, Co 89003	-
Top borer	Batala, Gurdaspur, Ajnala, Nawanshahr, Dasuya, Bhogpur, Mukerian	4-5	Co 0238, CoJ 85, Co 89003, CoJ 88, Co 0118	-
Pyrilla	Dasuya, Mukerian, Batala, Gurdaspur	4-5/leaf (5-6%)	Co 0238, CoJ 85, CoJ 88	-
Whitefly	Budhewal, Fazilka	Traces	Co 0238, CoJ 85, CoJ 64	-
Mite	Fazilka, Dhuri, Mukatsar, Faridkot	7-8/cm square (3-4%)	Co 0238, Co 89003. CoJ 64	-
Black bug	Dasuya, Budhewal, Phagwara, Mukerian, Gurdaspur, Morinda	3-4/Plant (5-6%)	Co 0238, CoPb 91, CoJ 85, CoJ 88, Co 89003	Black bug incidence more in sugarcane ratoon crop
Root borer	Dhuri, Kapurthala, Gurdaspur	2-3	Co 0238, CoJ 85, Co 89003	-
Stalk borer	Nakodar, Phagwara, Ajnala, Gurdaspur, Budhewal, Nawanshahar, Morinda	5-6	Co 0238, Co 89003, CoJ 85, CoJ 64, Co 0118	-

2. **Haryana**				
Pink stem borer	Mill zone of Karnal	3.5-18.6	CoH 160, Co 0238, Co J 85, Co 89003, Co 0118, Co 05011 & CoP 84212	Premonsoon
Thrips		4.2-8.5		
Shoot borer		3.4-45.6		
Black bug		23-38 bugs/whorl		
Top borer		3-6		
Top borer	---do--	5.6-42.8	Co 0238, Co 89003, CoH160 and Co05011	Monsoon
Stalk borer		8.0-11.5		
Black bug		5.0-25.4 bugs/whorl		
Web mite		5-65 % leaves infested		
Root borer		2.4-20.6		
Pyrilla		0-1.5 nymphs/ adults/ leaf		
White grub		1-2 grub/m^2		
Stalk borer	---do--	4.0-12.8	Co 89003, Co 0238, CoH 160, Co 0118 Co 05011, CoP 84212 & Co J 85	Postmonsoon
Root borer		4.3-14.1		
White grub		1-2 grubs/m^2		
Pyrilla		0.2-1.1 nymphs/ adults/ leaf		
Epiricania melanoleuca		1.2cocoons/leaf		
Black bug		4.0-11.2 bugs/whorl		
Top borer		4.3-39.5		
Thrips	Mill zone of Yamuna Nagar	2.0-13.5 % infested leaves	Co 89003, Co 0238 & CoH 160	Premonsoon
Shoot borer		2.5-20.8		
Black bug		4.0-12.5bugs/whorl		
White grub	---do--	1-4 grubs/m^2	Co 89003, Co 0238, CoH 160, Co 05011 & Co 0118	Monsoon
Webbing mite		20-67 % leaves infested		
Whitefly		4-11 nymphs & puparia/2.5 cm^2		
Black bug		3.5-16.7 bugs/whorl		
Top borer		5-35 % infestation		
Shoot borer	Mill zone of Shahbad	3.5-24. 5 infested shoots	Co 89003, Co 05011, Co 0238 & CoH 160	Pre-monsoon
Black bug		2.0-15 bugs/whorl		
Top borer		1.0-5.0 % infestation		
Top borer		7.5-20.0% infestation	Co 0238, CoH 160, Co 05011 & Co 89003	Monsoon
Webbing mite		8-55 % leaves infested		
Whitefly		2-15 nymphs & puparia/2.5 cm^2		
Pyrilla		1-2 nymphs & adults/ leaf		
Epiricania melanoleuca		2-4 cocoons/ leaf		
	---do--			

Black bug	Mill zone of Sonepat	3.2-9.4 bugs/whorl	Co 89003, Co 0118, Co 0238 & CoH 160	Pre-monsoon
Shoot borer		2.0-23.5 %		
Black bug	Panipat	2-8 bugs/whorl	Co 89003, CoH 160 & Co 0238	Monsoon
Top borer		4.0-26.5 infested plants		
Black bug	Mill zone of Rohtak	2-12 bugs/whorl	Co 89003, Co 0118, CoH 160 ,CoH 119 & Co 0238	Monsoon
Top borer		5.0-42 5 infested plants		
Whitefly		5.5-18.5 nymphs & puparia/2.5 cm^2		
Top borer	Mill zone of Assandh	5.0-60.0 infested plants	Co 89003, Co 0238, CoS 88230 & CoH 160	Monsoon
Web mite		4.0-42 % leaves infested		
Whitefly		3.0-12.9nymphs & puparia/2.5 cm^2		
Root borer		10.5-15.6		
Stalk borer	---do--	6-17 5 infestation	Co 89003, Co 0238, CoH 160 & CoS 88230	Post monsoon
Pyrilla		1.5 nymphs & adults/ leaf		
Epiricania melanoleuca		1-4 cocoons/ leaf (3.4 % parasitisation)		
Stalk borer	Mill zone of Jind	5-20 % infestation	CoH 119, Co 89003, CoH 160 & Co 05011	Post monsoon
Pyrilla		1-3 nymphs & adults/leaf		
Epiricania melanoleuca		1-4 cocoons/leaf		
3. **Uttar Pradesh**				
Early shoot borer	Gola (Lkahimpur kheri)	4.00	Co 0238, CoS 8432	-
Top shoot borer		3.00		
Thrips		10.00		
Mealy bug		2.50		
Early shoot borer	Hargaon (Sitapur)	4.00	Co 0238, Co 98014, CoPant 03220 CoS 08272, CoLk 94184 CoJ 85	-
Top shoot borer		5.00		
Mealy bug		3.00		
Early shoot borer	Kumbhi (Kheri)	4.00	Co 0238, CoJ 88, CoS 08279, Co 0118	-
Top shoot borer		3.00		
Mealy bug		7.50		
Thrips		3.00		
Mite		7.50		
Top shoot bore		3.50		
Gurdaspur borer		2.00		
Termite		9.00		
Thrips		25.00		
Whitefly		27.50		

Early shoot borer	Khambarkhera (Kheri)	3.50	Co 0238	
Top shoot bore		3.50		
Stalk borer		11.00		
Gurdaspur borer		1.50		
Mite		32.50		
Early shoot borer	Maqsudapur (Shahjahanpur)	4.00	Co 0238, CoS 08276, CoLk 94184	-
Top shoot borer		3.50		
Stalk borer		8.50		
Early shoot borer	Nihoghi (Shahjahanpur)	3.50	Co 0238, CoLk 98184	
Top shoot borer		3.00		
Stalk borer		11.00		
Early shoot borer	Gularia (Kheri)	3.50	Co 0238, CoS 08279, Co 98014 CoS 08272	-
Top shoot bore		5.00		
Stalk borer		8.50		
Gurdaspur borer		6.00		
Termite		22.50		
Early shoot borer	Aira (Kheri)	3.50	Co 0238, CoLk 94184, CoSe 01434, Co 98014	-
Top shoot borer		4.00		
Stalk bore		8.00		
Root borer		2.50		
Thrips		32.50		
Mite		65.00		
Early shoot borer	Pallia (Kheri)	2.50	Co 0238, Co 98014	-
Top shoot bore		4.50		
Stalk borer		7.50		
Gurdaspur borer		9.00		
Early shoot borer	Ajabapur (Kheri)	2.50	Co 0238, Co 05011	-
Top shoot bore		4.00		
Stalk borer		7.50		
Mealy bug		5.50		
Early Shoot Borer	Seorahi	6.00	Co 0238, 0118, CoS 08272,08279 ,CoSe 01434,08452	-
Top Borer		7.00		
Stalk Borer		4.00		
Thrips		13.00		
Early Shoot Borer	Mankapur	3.00	Co 0238, 0118,5011,UP 05125	-
Top Borer		3.00		
Stalk Borer		3.50		
Thrips		15.00		
Early Shoot Borer	Balramp[ur	3.50	Co 0238, 0239, 0118,98014 CoS 88230, 91269, 97261, 767, 8436, CoSe 92423, 01434, CoLk 94184 ,UP 039	-
Top Borer		3.00		
Stalk Borer		5.50		
Thrips		11.00		

Early Shoot Borer	Babhnan	5.00	Co 0238, 98014, CoSe 08279, 8432, CoLk 94184, CoJ 88	-
Top Borer		6.00		
Stalk Borer		4.00		
Root borer		7.50		
Thrips		13.50		
Early shoot borer	Mill zone of Chilbaria Nanpara Bahraich and Hata	5-15	-	-
Root borer		20	-	
Army worm		10-60	-	
Sugarcane black beetle		5-20		
4. **Bihar**				
Root borer	Kalyanpur	2.50	BO 130, CoSe 95422, CoP 2061, BO 153	-
Pyrilla/leaves		10.00		
Shoot borer		9.50		
Top borer		15.00		
Pyrilla	Madhopur	14.00	CoP 9301, BO 153, CoSe 95422, CoSe 14454	-
Shoot borer		11.00		
Root borer		4.50		
Pyrilla	Bandra	8.00	BO 130, CoSe 13452	
Army warm		6.00		
Pyrilla	SRI,Pusa	5.00	BO 91, BO 146, BO 130, CoP 2061, CoP 9301, CoSe 95422	-
Top borer		15.00		
Plassy borer		14.50		
Army warm		5.00		
Shoot borer		8.50		
Stalk borer		2.00		
Root borer		3.50		
Army warm	Jatmalpur	7.50	BO 91, BO 130, CoP 12436, CoP 14438	-
Top borer		12.0		
Shoot borer		7.00		
Pyrilla	Pusa Farm	8.00	CoP 2061, COLK 94184, BO 154, CoP 2061	-
Root borer		4.50		
Scale insect		3.00		
Shoot borer		5.00		
Top borer		10.50		
Stalk borer		4.50		
Plassy borer		8.00		
5. **Maharshtra**				
Internode borer	Ghuikhed Tal. Chandur Railway Dist. Amravati	12.00	Co-265 (Ratoon) and CoVSI- 3102	-
Pyrilla		10.00		

Whitefly	Bhidi Tal. Deoli Dist. Wardha	6-7/ cm^2	Krishna 7714 Co-265	-
Whitefly	Bhidi Tal. Deoli Dist. Wardha	18-20/ cm	Co-8005	-
Internode borer	Shripur Tal. Mahagaon Dist Yavatmal	14.00	Co-3102	-
Internode borer	Mahakal Tal. Wardha Dist. Wardha	12.00	Co-8005 1234 Co-265	
Pyrilla		10.00		
Whitefly		9.00		
Early shoot borer	Malegaon (Baramati), Nimbut (Baramati), Padegaon (Phaltan), Padegaon (Khandala), Pandare (Baramati	14.33	Co 86032, CoM 0265, MS 10001	-
Top shoot borer		0.05		
Internode borer		14.67		
Woolly aphid		2.33		
Scale insect		02.67		
Mealy bug		15.33		
White grub		07.33		
Termite		1.33		
Derbid plant hopper		03.33		
6. **Madhya Pradesh**				
Early shoot Borer	Kareli, Bankhedi, Gadarwada, Hoshangabad	11.77	-	-
Top shoot borer		2.68		
Root borer		1.52		
Pyrilla /Leaf		4.58		
Whitefly (per 2.5 sq.cm.)		0.64		
7. **Gujarat**				
Early, Top borer and root borer	Ganesh Vatariya Sugar factory area	6.71	Co86032, CoSi 95071 CoM 265, MS 10001	-
White fly		8.71		
Early shoot borer & Top borer	Sayan sugar factory area	6	Co 86032, Co 86002 CoSi5071 CoN 07072 CoN 05071, CoM 265,MS 10001	-
White fly		10		
Early shoot and Top borer	Valsad Sugar factory area	10.03	MC 707 (Co 9007) Co 86032, CoN 07072	-
Early, Top & Root borer	Bardoli Sugar factory area	4.30	Co 86032, Co 86002 MC 707 (Co 9007) CoN 07072 CoN 05071, Co M 265,MS 10001	
White fly		1.77		
Rodent		1.57		
White fly	Mahuva Sugar factory area	1-2	Co 86002,Co 86032, Co M 265 and MS 10001	
Thrips		1-3	Co 86032, Co 86002, MC 707 (Co 97009), Co M 265 ,CoN 05071,CoN 07072 and CoN 95132	

8. **Karnataka**				
Early shoot borer	Chamundi sugars K.M.Doddi Maddur	18.50	Co86032 Co62175 VCF 0517	-
Top shoot borer		11.50		
Internode borer		23.50		
Woolly aphid		18.00		
Mite		21.00/Cm²		
Abacarus sacchari		17.0/Cm²		
White grub		4/m²		
Army worm		5.0 larva /plant		
Un identified weevil		2.0 adults / plant		
Early shoot borer	My Sugar Co. Mandya	11.25	Co86032 Co62175 Co99463 Co86032	
Top shoot borer		9.50		
Internode borer		16.00		
Woolly aphid		16.00/ Cm²		
Saccharicoccus sacchari		13.25%		
White grub		3.00/m²		
Abacarus sacchari		14.0/Cm²		
Pyrilla		0.5 nymph/ adult/plant		
Whitefly		6.0 nymphs/ Cm²		
Early shoot borer	N.S.L.Sugars Koppa,K.R.Pet	11.00	Co86032 Co62175 Co99463 VCF 0517	-
Top shoot borer		7.50		
Internode borer		24.00		
Saccharicoccus sacchari		63%setts failed to germinate		
Pyrilla		0.5 nymph/ adult/plant		
Abacarus sacchari		15.0/Cm²		
White grub		3.00/ m²		
Termite		12.05% setts affected		
9. **Andhra Pradesh**				
Early shoot borer	Vizianagaram district Anantavaram, Gandhavaram, L. Kota, M. Singavaram, Barthavani palem in Bheemasingi Cooperative sugar factory	43.0	Co A 92081, Co V 09356, Co A 08 323, CoA06321	March-June
Yellow mite		7.5	Co A 07321 (2000 A 56), Co A 08 323	May
Mealy bug		12.5	Co A 92081	April-May
Whitefly (puparia/ sq.inch)		30	Co A 92081	September
Internode borer		35	Co A 92081, Co V 09 356, , Co A 08 323	September
Scale insect		50	Co A 92081	November-December

Early shoot borer,	Operational area of EID parry, Sankili, Srikakulam district	16.0	Co A 92081, CoA06321	March-May
Red mite		4.00	Co A 92081	March
Internode borer		38.50	Co A 92081	August
Scale insect		35	Co A 92081	-
Early shoot borer	Parupaka, M Chemavaram, Mokapalli, China sankerlapudi, Poduru villages of Routhulapudi & Eleswaram, Kirlam pudi mandals in East Godavari district	32.50	Co V 09 356, Co A 92081, Co 86032	May
Red mite		9.50	Co A 92081	May
Mealybug		22.5	Co 86032	May
Whitefly (nymphs & pupae/sq.inch)		32.5	Co V 09 356	September
Internode borer		45.0	Co A 92081, Co V 09 356, Co86032	September
Scale insect		32.5	Co V 09 356, Co A 92081, Co 86032	November-December
Early shoot borer (%)	Sugarcane fields in Munagapaka mandal and Chodavaram mandal in Visakhapatnam district	27.50	Co A 92081, Co A 62175, Co 7805	March-June
Red mite (%)		8.00	Co V 89101, CoA06321	May
Mealybug (%)		20.5		April-May
Sugarcane aphid (N & A/leaf)		18.5/leaf		October
Internode borer (%)		55.0		August-November
Scale insect (%)		55.0		November-December
10. **Tamil Nadu**				
Shoot borer	Telungupalayam	2.22-9.74	Co 86032	-
Internode borer		2.38-11.76		
Top borer		0.56-1.17		
Shoot borer	Athipalayam	1.26		
Top borer		0.63		

E.30: Monitoring of insect pests and bio-agents in sugarcane agro-ecosystem

North Western Zone

1. Kapurthala

The incidence of early shoot borer was noticed from April to July. The top borer incidence started from month of May to August. The bio-agents *viz.*, *Rhaconotus* sp., *Isotima javensis* and *Stenobracon* sp. were observed.

2. SBI-RC Karnal

The cumulative incidence of pink borer was 45.0 per cent. The incidence of early shoot borer and top borer was below ETL (<15.0 and <10%, respectively). Root borer and termite incidence was 26.6 and 7.0%, respectively. Stalk borer incidence, intensity and infestation index were 39.6%, 8.5% and 3.4, respectively. The Pyrilla population was 2.0 individual/20 leaf. Among bio agent's, *Epiricania melanoleuca*, was observed with 22.3 per cent parasitization of pyrilla. *Tetrasticus pyrillae*, an egg parasitoid of pyrilla, parasitized 28.3 per cent egg masses. *Isotima javensis* and *Stenobracon deesae* parasitization of top borer larvae was 1.2 and 0.6 per cent respectively. Parasisitisation of stalk borer by *Cotesia flavipes* was 9.3 % during August – February.

3. Shahjahanpur

The percent incidence of stalk borer (on cane basis) was observed to be maximum 19.50% during 43rd followed by 12.25% during 38th SMW, respectively. The bio-agents viz., *Telenomus beneficiens, Isotima javensis, Rhaconotus scirpophagae,Stenbracon deesae* and *Cotesia flavipes* were observed in experimental field.The peak activity of egg-parasitoid, *T. beneficiens* was observed to be 11.00%

during 31st SMW and declined up to 3.00% during 35th SMW.

4. Lucknow

Due to termites, bud damage ranged from 8.33 to 33.33 per cent in CoLk 94184. Complete sett damage was 0.5 to 1.5 % and live workers were also seen (5 to 50 per sett).Incidence of top borer II, III and IV brood was 9.01 to 18.85, 10.20 to 19.62 and14.03 to 23.16 percent, respectively. Incidence of root borer was 18.18 to 48.00 per cent in July and in the month of September it was 35.71 to 62.96 per cent. Incidence of internode borer was low while the incidence of stalk borer is on increasing trend. Mealy bug and black bugs were present in every clump. Parasites like *Telenomus beneficiens* (80.0 % on egg mass basis). Total parasitisation of top borer was 41.43 %. due to *Stenobracon* sp. (5.76%), *Rhaconotus* sp. (8.81%) and *Isotima javensis* (26.86%).

5. Uchani

Incidence of pink borer was observed in April (6.4%), May (4.6%) and June (6.6%). Incidence o top borer II, III and IV brood was 26.2, 34.3 and 34.6 per cent, respectively. Incidence of stalk borer was low The incidence of root borer was noticed during month of July (7.2 %). During October its population reached 10.5 per cent and there after population of root borer increased gradually and reached to a maximum of 14.2 per cent during month of March.

North Central Zone

1. Pusa

The mean per cent incidence of root borer, shoot borer, Top borer and stalk borer were varied from 1.5 to 9.5 %, 2.2 to 14.8%, 0.80 to 17.0% and 1.8 to 4.2% respectively. The incidence of Pyrilla varied from 0.25 to 11.30/ leaf. But parasitization of to borer was observed. Peak parasitisation of top borer by *Stenobracon deesae* (10.20%) noticed in September. Population of *Apantelis flavipes* was ranged in between 2.5 to 13.5 during May to November with its highest population (13.5%) in September. The activity of *R. scirpophagae* was recorded from July to November with its peak (8.2%) in month of September. The parasitization of *T. pyrillae* and *E. melanoleuca* were recorded from July to November and May to November, respectively. Their peaks were noticed in the month of November (30.15%) and September (20.20%), respectively. Parasitizastion of stalk borer by *Cotesia flavipes* was recorded from 6.20 to 14.2% during August to November.

2. Seorahi

The incidence of shoot borer was recorded maximum 8.26% during 24th SMW followed by 6.04%, 3.72% and 2.21% during 20th, 16th and 29th SMW respectively. The incidence of top borer was low. The percent incidence of stalk borer (on cane basis) was observed to be maximum 11.20% during 43rd SMW followed by 7.20% during 38th SMW, respectively. The bio-agents viz. *Isotima javensis*, *Stenobracon sp.*, *Elasmus zehnteri* and *Rhaconotus scirpophagae* are the parasotoide of top borer were observed and *Cotesia flavipes*, a larval parasitoid of stalk borer was also recorded from the field . A parasitisation of larvae by *Isotima javensis* was recorded minimum 2.00% during 22th SMW and increases up to 18.18% during 35th SMW. The parasitisation of *Stenobracon sp* was observed with minimum 2.85% during 22nd SMW and increases up to 15.00 % during 35th SMW. The parasitisation of Top borer by *Elasmus zehnteri* was observed with 4.00% during 26th SMW and increases up to 11.11% during 35th SMW. *Rhaconotus scirpophagae* was up to 10.00% during 35th SMW.

Peninsular Zone

1. Akola

Incidence of early shoot borer on Co 86032 has shown non-significant correlation with morning relative humidity, evening relative humidity, rainfall and maximum temp. Similarly, in case of scales the incidence of scales has also shown non-significant correlation with rainfall and Relative humidity at evening. But it showed Significant correlation with relative humidity at morning hours, max. Temperature and min. Temperature. *Pyrilla* it showed significant correlation with relative humidity at morning and evening hours, rainfall and max. temperature and non-significant with min. temperature.

2. Padegaon

The incidence of early shoot borer ranged from 0.67 to18.33 per cent. The peak incidence of early shoot borer was observed in 18 MW and it was 18.33 per cent. The incidence of pyrilla per leaf was ranged from 1 to 4. The first incidence of woolly aphid was observed in 30 MW and it was 0.67 woolly aphid per leaf. However, the peak incidence was observed in 48 MW and it was 34.67 woolly aphid per leaf. The parasitoid, *Encarsia flavoscutellum* was ranged from 1 to 127 per 150 leaves. The predator, *Micromus igorotus* was ranged from 1 to 54 per 150 leaves. The peak predatism of *D. aphidivora* on woolly aphid was observed in 44 MW and it was 27 *Dipha* per 150 leaves. The *Syrphids* was observed since 39 MW of 2017 to 3 MW of 2018.

3. Pune

The percentage incidence of early shoot borer was noticed maximum 16.97 in June 2017. The incidence of internode borer was noticed maximum 38% in November 2017. This plot was free from mealy bug and scale insect infestation.

4. Powarkheda

The infestation of early shoot borer initiated (0.2%/week) at 7th SMW (3rd week of Feb.). Thereafter, it increased gradually and reached to the seasonal peak activity (>2.5%/week) from 12th to 15th SMW. Afterwards, ESB observed decline trend and its activity seized after 22nd SMW. Maximum day temperature of >30^{O}C, minimum of near 11^{O}C above, RH of <90%, respectively seems to be favorable to initiate the ESB activity. While, maximum temperature of 38 to 40^{O}C, minimum of >14^{O}C, morning and evening RH <70 %, found to be conductive to induce the peak activity of ESB. Throughout the season, no pyrilla and its parasitoid i.e., *Tetrastichus_pyrillae* or *Epiricania melanoleca* recorded. Negligible pyrilla individuals as well as Tetrastichus parasitoid eggs observed at last week of August.

5. Navsari

Incidence of top shoot borer in 20, 28 and 50 SMW was 1.14, 2.62 and 1.91 respectively. During period of study per cent parasitism by *T. japonicum* was 4.31, 2.68 and 1.11, respectively. *T. chilonis* found to be parasitizing at the rate of 1.18, 1.62 and 0.97 per cent, Parasitism done by *Apanteles flavipes* was ranged from 1.09 to 1.89 per cent. Fungus parasitism ranged from 0.94 to 1.13 % caused by *B. bassiana.*

6. Mandya

Cumulative incidence of ESB in Co 86032 sugarcane variety was 23.35 % in the first four months after planting. Incidence of TSB was 23.98% at 7th month. Incidence of internode borer was 29.60%. Aphid, whitefly, and pyrilla appeared in very small numbers but failed to establish and spread. Woolly aphid incidence was observed at 150 and 180 days after sowing and it was restricted to few clumps. *Dipha* (2larva/2pupa/clump) *Encarsia* (6 adults/leaf), kept the woolly aphid under control. Sugarcane pink mealy bug *S.sacchari* infested 8.50% millable canes with 22.65% intensity.

7. Kolhapur

Not conducted

8. Coimbatore

Incidence of shoot borer in May and July was 8.41 % and 9.34 %, respectively. Top borer incidence was less than one while incidence of sucking pests was in traces. *Telenomus dignus* was active throughout the year.

East Cost Zone

1. Anakapalle

The maximum incidence in ratoon crop (17.15%) of early shoot borer was recorded in March. In plant crop maximum incidence (15.97%) was in 60 days old crop in April. On early shoot borer, parasitisation of *Trichogramma chilonis* (1.0 - 2.6 %), *Sturmiopsis inferens* (1.8%) were observed. The maximum incidence (25.36%) of internode borer was in November. Rusty plum aphid, *Hysteroneura setariae* Thomas (3-13/leaf) was observed along with syrphid fly population (3-5/leaf) during the month of July and incidence of sugarcane aphid, *Melanaphis scacchari* was observed from August to January with maximum incidence in November (11-23/leaf) and December (16-21/leaf). Incidence of scale insect was commenced from November month (10%) as the fairly well spread non-beating rains (<100 mm/day) coupled with high humidity (90 - 92%) from September on wards. The incidences of *Pyrilla* (1-2/ leaf) & derbid leafhopper, *Proutista moesta* (1-3/leaf) were very negligible. *Trichogramma chilonis* and *Sturmiopsis inferens* parasitising on early shoot borer & internode borer eggs, larvae and *Tetrastichus pyrillae, Epiricania melanoleuca* parasitising on *Pyrilla* eggs and nymphs, adults were prevalent.

E. 34: Standardization of simple and cost effective techniques for mass multiplication of sugarcane bio-agents

North Western Zone

1. Lucknow

Rearing of black bug, *Dimorphopterusgibbus* (Fabricius) and *CaveleriusSweeti* Myamoto.

Rearing of black bug completes in to two steps. 1. Egg laying, a muslin bag measuring 20.0 x 8.0 cm was developed. Three to four cut topes of sugarcane with 5 cm leaf portion are kept in a muslin bag and charged with 50 pairs of adult insects. Charged bags are kept in tray for egg laying. Eggs are collected for the mass multiplication Eumicrosoma spp. egg parasitoids of black bugs.

Mass multiplication of *Eumicrosoma*sp (Hymenoptera: Sceilionidae) an egg parasitoid of Lygaeid bugs of sugarcane

Fresh eggs (fresh or 24 hour old) are offered to the gravid female in homoeopathic vials for parasitization. Parasitized eggs became blackish in colour from one end and in few days turned completely black to shiny black just before hatching. Single gravid female could parasitize on an average of 15.67 eggs with a range of 5-22 eggs. Development period of prasitoid varies from 7-11 days. Parsitisation and longevity of adults varies from 62.5 to 91.50 per cent and 1-3 days, respectively.

2. Uchani

Trichogramma chilonis has been multiplied at large scale on the eggs of *Corcyra cephalonica* in the laboratory and distributed to the farmers for the management of top borer

and stalk borer of sugarcane. Nymph and adult parasite of *Pyrilla perpusilla* was multiplied on laboratory reared *Pyrilla perpusilla*.

Peninsular Zone

1. Padegaon

Chryoperla carnea (*C. zastrowi sillemi*) multiplied in fifty per cent green shade net. About 2-5 neonate larvae cane be developed on single stool of sugarcane.

2. Pune

Trichogramma chilonis was multiplied on laboratory reared eggs of *Corcyra cephalonica* on Jowar. Four seventy five trichocards were produced and distributed to farmers.

3. Coimbatore

Mass multiplication of two entomopathogenic fungi viz., *Metarhizium anisopliae* and *Beauveria brongniartii* on diluted molasses both at 27 +-2 oC has been developed. Three weeks after inoculation sporulation was observed and used for its formulation and delivery purpose.

East Cost Zone

1. Anakapalle

The *Pyrilla* adults were collected from the field and reared under laboratory in glass jar, (15 ODx20 cm h) 25+- 1˚C. The bottom of the jar was filled with 4 to 5 cm thick layer of sterilized moist sand. About 10 cm long leaf cuts, 6 to 7 per jar were vertically thrust in the sand layer of glass jar. In each jar, 4-5 pairs of adult *Pyrilla*, were released for egg laying. The top of the jar was covered with muslin cloth by using rubber band.

Newly hatched nymphs were transferred daily with the help of a fine hair brush to other glass jar. At the interval of 4-5, nyphs have been shifting to fresh jars till nymphs converted to adult pyrilla. The adults lived for 25-30 days. The total life-cycle was completed within 45 to 61 days during October –November months

E.38: Formulation and validation of IPM Module of sugarcane insect pests

North Western Zone

1. Kapurthala

The incidence of early shoot borer, top borer in IPM block was 2.58 per cent and 1.15 per cent and in farmers practice it was 6.30 per cent and 8.90 per cent, respectively. Black bug population was less than one per cent in both of the blocks. Population of other sucking pests such as white fly, mite and *Pyrilla perpusilla* was significantly low in IPM block than the farmers practice plot. Data of cane growth, quality parameters and yield was recorded in IPM block and farmer practices block. Germination, number of tillers, total cane height, number of millable, girth of cane and number of internode and quality parameters were numerically higher in IPM block over farmers practice block.

2. SBI-RC Karnal

During the initial stage of crop establishment infestation by pink stem borer, *Sesamia inferens* was reported 1.02 per cent in IPM block and 1.74 per cent in farmers' practice. Damage to crop by this pest started just after germination of crop and remained up to end April . Incidence of shoot borer was reported 3.38 per cent in IPM block and 8.85 per cent in farmers' practice. Top borer infestation was observed to begin in mid May .The infestation was shown to rise with the build up of second brood raising the population density to 1.62 per cent infestation as against as high as 16.78 per cent in farmers' practice field's. The damage of stalk borer started during month of July, its incidence being relatively low (0.41 infestation index) in IPM block as compared to 1.34 infestation index in farmers' practice field. The incidence of root borer was 4.53 in IPM block as compared to 9.26 in farmers' practice block. Infestation by sucking insect-pests (black bug,whitefly web mite and pyrilla) was reported comparatively low in IPM block as compared to farmers' practice. The germination at 120 DAP was recorded 57.5 per cent in IPM block and 56.4 per cent in farmers' practice block. Number of tillers recorded at 120 DAP indicate that 126.4 (000/ha) tillers were recorded in IPM block as compared to 123.2 (000/ha) tillers in farmers' practice block. Observations on number of millable canes at 360 DAP indicate that 114.4 (000/ha) canes were recorded in IPM block as compared to 108.5 (000/ha) canes in farmers' practice block. Observations on quality parameters was recorded at 360DAP. Brix and purity was recorded as 20.72 and 90.64 per cent in IPM block and 19.84 and 87.84 per cent, respectively in farmer practices block. CCS was 12.81 per cent in IPM and 12.48 per cent in farmers' practice. Sucrose was recorded 19.43 per cent in IPM and 18.52 per cent in farmers' practice block. Cane yield was 92.6 t/ha in IPM block and 81.2 t/ha in farmers' practice block.

3. Shahjahanpur

The germination in IPM block was 64.11 percent as against 52.00 percent in farmers practice block. Incidence of early shoot borer (2.03%), 3rd brood of top borer (2.00%), 4th brood of top borer (2.55%) and at harvest (4.67%) was low as against 6.21, 2.88, 4.48 and 7.33 percent in the untreated block, respectively. The IPM block recorded higher number of tillers (129000/ha), millable canes (109000/ha) and cane yield (71.8 MT/ha) against 109000, 97000/ha and 63.6 MT/ha, respectively in the untreated

block. Regarding the growth attributes the IPM block recorded higher total cane height (2.79 m) millable cane height (1.94 m), number of internodes (24) and cane girth (1.58 mm) against 2.78, 1.87 and 23 in untreated block respectively. In IPM block the sucrose percent in juice was recorded 17.89 against 17.43 in untreated block.

4. Lucknow

Not conducted.

5. Uchani

Incidence of pink stem borer, *Sesamia inferens* was observed as shoot borer and numerically low in IPM block than farmers practice block. Incidence of early shoot borer, top borer II brood, stalk borer and root borer was singnificantly low in IPM block. Incidence of whitefly, web mite was significantly low in IPM block over farmers practice block. Data on growth, yield & quality parameters and cane yield was recorded in IPM block and farmers' practice block. Germination at 120 DAP was recorded 57.5 per cent in IPM block and 56.4 per cent in farmers' practice block. Other yield and quality parameters were superior in IPM block over farmers practice block. Cane yield was 92.6 t/ha in IPM block and 81.2 t/ha in farmers' practice block.

North Central & North Eastern Zones

1. Pusa

The germination, no. of millable cane/ha, cane yield (kg/ha) being 21.30%, 20.96% and 18.38%, respectively, which were increased over farmer practices under yield parameter characters of the crop. In growth parameters, millable cane height (2.96%) and no. of internodes (2.20%) were increased over farmer practices. The incidence percentage of borer pests were reduction over farmer practices varied from 13.63 to 17.97 and maximum (17.97%) incidence reduction was noticed with plassey borer. The maximum (16.80) reduction in incidence of mealy bug and minimum (13.11%) reduction with scale insect over farmer practices. Whereas quality parameters like brix, sucrose, purity and CC5 were 1.90%, 1.8%, 0.5% and 2.1% respectively were higher in IPM block over farmers practice.

2. Seorahi

The IPM block recorded 50.83 percent germination against 45.00 percent in untreated block. The treated block also recorded minimum cumulative incidence of shoot borer (9.92%), 3rd brood of top borer (2.25%), 4th brood of top borer (2.98%) and at harvest (5.65%) against 14.12, 4.09, 6.08 and 8.80 percent in the untreated block, respectively. Regarding the stalk borer infestation the infestation index was 0.21 in IPM block against 0.37 in untreated block. The IPM block recorded higher number of tillers (169000/ha), millable canes (118000/ha) and cane yield (104 MT/ha) against 153000, 107000/ha and 83.33 MT/ha, respectively in the untreated block. The increase in cane yield in IPM was 23.88 percent higher over untreated block. Regarding the growth attributes the IPM block recorded higher total cane height (277.59 cm) millable cane height (244.13 cm), number of internodes (23) and cane girth (21.99 mm)against 254.56, 198.95 and 20 in untreated block respectively. IPM block the sucrose percent in juice was recorded 19.10 against 18.75 in untreated block.

Peninsular Zone

1. Akola

Not Conducted

2. Padegaon

The cumulative incidence of early shoot borer in IPM block was 6.95 % as it was recorded 25.10% in farmers practice block. Incidence and intensity of internode borer was 15 and 1.33% in IPM block as compared to farmers practice 35 and 3.06 per cent at harvesting. IPM block recorded 86.85 thousand millable canes per ha as compare to farmers practice 71.76 thousand /ha. In IPM block higher cane yield (110.28 t /ha) was recorded as compare to farmers practice (76.30 t /ha).

3. Pune

The cumulative per cent incidence of early shoot borer was 0.53 % in IPM block, while it was 5.44 per cent in farmers practice block. At harvest plant plant population per hectare was numerically high 70714 in IPM block as compared to farmers practice block 64615. Sugarcane yield per ha was higher in IPM block than farmers practice block.

4. Powarkheda

The IPM block recorded 74.2 per cent germination, while in farmers practice block it was 69.2 per cent. In farmers practice block, 13.87 per cent early shoot borer infestation recorded, while it was 4.02 per cent in IPM block (i.e., 71.01 per cent less). Later on, experiment failed due to drought and lack of irrigation in later summer. Hence, the yield its quantity/ quality attributes couldn't be recorded.

5. Navsari

The highest millable cane yield of sugarcane was recorded 132.50 t/ha and it was (139.58 t/ha) in Farmers practices. Brix per cent, Sucrose per cent, Purity per cent and C.C.S per cent were found non-significant. The treatment did not show any significant difference in quality parameter. Growth parameters like germination per cent and numbers of tillers reported higher in farmers practices 49.14 per cent and 195320 per ha., respectively.

6. Mandya

In IPM plot, the incidence of major pests was low compared to farmers practice plot. Apart from this, the yield of IPM plot was 24.18 percent more than the farmers practice plot, with the cost benefit ratio of 1:4.36 in favor of IPM practice

7. Kolhapur

Not Conducted

8. Coimbatore

Not Conducted

East Cost Zone

1. Anakapalle

Less cumulative incidence of early shoot borer was recorded in IPM module (22.89 %DH) compared to zonal recommendation (27.87%DH) and in untreated control, it was 49.17%DH. The highest number of tillers was recorded in IPM module at 120 days after planting (84352/ha) compared to zonal recommendation (76435/ha) and untreated control (66509/ha). Less incidence and intensity of internode borer was recorded in IPM Module (23.91% &1.86%) compared to zonal recommendation (49.50%& 3.5%) whereas in untreated control, it was 65% & 4.78%. Incidence and intensity of scale insect was very less in zonal recommendation compared to IPM module (28.8 & 2.59%) whereas in untreated control, it was 56.02 % and16.52%. The highest NMC/ha and cane yield were recorded in IPM module (64,353/ha; 70.79 t/ha) compared zonal recommendation (63435 NMC/ha and 69.78 t/ha) whereas in untreated control, less NMC /ha and cane yield were recorded (53509/ha; 58.86 t/ha). Growth and quality parameters *viz*., millable cane height , Cane girth and percent juice sucrose were also comparatively more in IPM module (2.98 m/cane, 2.47cm/cane & 22.37%) than zonal recommendation (2.75 m/cane, 2.35 cm/cane & 21.56%) whereas in untreated control, it was very less (2.07 m/cane, 1.97cm/cane & 21.35%).

Summary

- The genotypes/varieties Co14035, CoLk 14203, CoPb 14185, Co 13035, CoH 12263, Co 12029, CoLk 12205, CoPant 12226, CoPb 12211, CoS 12232, Co 13035, Co13204 and Co 13034, Co 13231, CoPb 13182, CoH 13263, Co 13035, Co 12027, Co 12026 showed highly susceptible to top borer and root borer, respectively in North West Zone. However,CoH 12263, CoLk 12203, Co 12027, CoS 13231 showed HS to stalk borer in NWZ.
- Co14032, CoC671, CoT14367, CoVc14062, Co14025, CoT14112, Co14006, CoN14071, Co14016, Co14008 CoSnk14102, VSI14121, Co14030, Co14012, CoT14111, CoT14366, CoN14073, CoN14072, CoVc14061, MS14081, Co14022, Co14026, Co14009, Co14002, Co14023, Co14003, MS14082, Co13021, CoSnk14101, CoSnk14103, VSI14122, Co12009, Co12012, Co12019, Co12024, CoM12085, Co11001, Co85004, Co94008, Co11001, Co11004, CoM11081, CoM11082, CoM11084, Co85004, Co11007, Co99004, Co11005, Co11007, Co11012, Co11019 showed highly susceptible to scale insect in peninsular zone.
- The high incidence of black bug, thrips, web mite, top borer, root borer, ESB, army worm, white fly, internode borer, woolly aphid, mealy bug were reported on different varieties in different zones.
- The maximum incidence of ESB, StB, PB, white fly and rusty plum aphid was observed in the month of May, November, April, August and July, respectively in different zones. A new insect spittle bug, *Poophilus costalis* (Walker) was observed in sugarcane leaves in A.P.
- The bio-agents, *Trichogramma chilonis, Stenobracon sp. Rhaconotus scrpophagae, Isotima javensis, Cotesia flavipes, Sturmiopsis inferens, Fulgoraecia melanoleuca, Cheiloneurus pyrillae, Tetrastichus pyrillae,* and *Beaveria bassiana* were observed on insect-pests in different zones.
- Mass multiplication oof egg parasitoid, *Trichogramma chilonis*, *Eumicrosoma* sp.; fungi, *Beaveria brongniartii & Metarhizium anisopliae* and host, *Pyrilla perpusilla* in the laboratory and *Chrysoperla zastrowi sillemi* under field condition was done on different hosts.
- The incidence of major insect- pests, yield, BC ratio and quality attributes in IPM plot was low compared to farmers practice p

PERFORMANCE OF CENTRES IN CONDUCTING AICRP TRIALS (2017 - 2018)

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
PENINSULAR ZONE					
1.	Akola	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	IVT (E), AVT (E)-I P,
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	NIL	All
		Plant Pathology	PP 17 (D), PP 31	PP 31	PP 17 (D)
		Entomology	E 4.1, E 28, E 30	All	NIL
2.	Coimbatore	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	AS 68, AS 72	AS 69, AS 70, AS 71,
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 22, PP 33	All	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 38	E 4.1, E 28, E 30, E 34,	E 38
3.	Kolhapur	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	NIL	NIL
		Plant Pathology	PP 17B, PP 17D, PP 22, PP 28B, PP 31, PP 32	All	NIL
4.	Mandya	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	All	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 38, E 32	E 4.1, E 28, E 30, E 32	E 34, E 38
5.	Navsari	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	All	NIL
		Plant Pathology	PP 14, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23	All	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 38	E 4.1, E 28, E 30, E 38	E 34
6.	Padegaon	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	All	NIL
		Plant Pathology	PP 17B, PP 17D, PP 22, PP 28(b), PP 32	All	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 36, E 38	All	NIL
7.	Perumalapalle	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
8.	Powarkheda	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	Nor reported	
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	Nor reported	
		Plant Pathology	PP 17A, PP 17B, PP 17D, PP 22	Nor reported	
		Entomology	E 4.1, E 28, E 30, E 38	All	NIL

9.	Pravaranagar	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
10.	Pugalur	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	NIL	NIL
11.	Pune	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	All	NIL
		Plant Pathology	PP 17B, PP 17D, PP 22, PP 28(b), PP 31, PP 32, PP 33	All	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 38	All	NIL
12.	Rudrur	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)- II P, AVT (M) –R	All	NIL
13.	Sameerwadi	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
14.	Sankeshwar	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	AS 68, AS 69, AS 72	AS 70, AS 71
		Plant Pathology	PP 17B, PP 17D, PP 22, PP 28(b), PP 31, PP 32, PP 33, PP 17C	PP 17B, PP 17D, PP 22, PP 28(b), PP 31, PP 32, PP 33,	PP 17C
15.	Thiruvalla	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	All	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17D, PP 22, PP 17 B	PP 14, PP 17A, PP 17D,	PP 14A, PP 22,PP 17B
East Coast Zone					
1.	Anakapalle	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	AS 68, AS 70, AS 71, AS 72	AS 69
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23, PP 28(b), PP 31, PP 33	All	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 38	All	NIL
2.	Cuddalore	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-I P, IVT (M), AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 69, AS 70, AS 71, AS 72	All	NIL
		Plant Pathology	PP 14, PP 17A, PP 17B, PP 17C, PP 22, PP 23, PP 33	All	NIL
3.	Nayagarh	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-I P, IVT (M), AVT (M) – II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	All	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23, PP 31	PP 14A, PP 17A, PP 17B, PP 17D, PP 22, PP 31	PP 14, PP 17C, PP 23
4.	Nellikuppam	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (M)-I P, AVT (E)-R, IVT (M), AVT (M)-II P, AVT (M)-R	All	NIL
5.	Vuyyuru	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (M)-I P, AVT (E)-R, IVT (M), AVT (M)-II P, AVT (M)-R	All	NIL

North Central Zone					
1.	Bethuadahari	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72 (E), AS 72 (M)	Not conducted	
2.	Motipur	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-II P, AVT (M)-R	AVT (M)-I P
		Agronomy	Not assigned		
		Plant Pathology	PP 17A, PP 17B	All	NIL
3.	Pusa	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72(E), AS 72 (M)	All	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23, PP 31	PP 14, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23, PP 31	PP 14A
		Entomology	E 4.1, E 28, E 30, E 36, E 38	E 4.1, E 28, E 30, E 36,	E 38
4.	Seorahi	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72 (E), AS 72 (M)	AS 68, AS 70, AS 71, AS 72 (E), AS 72 (M)	AS 69
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23, PP 31	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 22, PP 23, PP 31	PP 17C
		Entomology	E 4.1, E 28, E 30, E 37	All	NIL
North Eastern Zone					
1.	Buralikson	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-II P, AVT (M)-R	AVT (M)-I P
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72 (E)	AS 69, AS 70, AS 72 (E)	AS 68, AS 71,
		Plant Pathology	PP 17A, PP 22	All	NIL
North West Zone					
1.	Faridkot	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72(E), AS 72(M)	All	NIL
2.	Karnal (SBI)	Plant Breeding	IVT (E), AVT (M)-II P, AVT (M)-R, AVT (E)-I P	All	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17D, PP 22, PP 23	PP 14, PP 17A, PP 17D, PP 22, PP 23	PP 14A
		Entomology	E 4.1, E 28, E 30, E 38	E 4.1, E 28, E 30,	E 38
3.	Kota	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72(E), AS 72(M)	AS 69, AS 70, AS 71, AS 72(E), AS 72(M)	AS 68

4.	Lucknow	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 67, AS 68, AS 69, AS 70, AS 71, AS 72(E), AS 72(M)	AS 68, AS 69, AS 70, AS 71, AS 72(E), AS 72(M)	AS 67
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 33, PP 23	PP 14, PP 17A, PP 17B, PP 17C, PP 17D, PP 22 pp 23	PP 14A, PP 33
		Entomology	E 4.1, E 28, E 30, E 34, E 38	E 4.1, E 28, E 30, E 34	E 38
5.	Kapurthala	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72(E), AS 72(M)	All	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 22, PP 23, PP 31	All	NIL
		Entomology	E 4.1, E 28, E 30, E 38	All	NIL
6.	Muzaffarnagar	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	NIL
7.	Pantnagar	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	AVT (E)-I P, AVT (E)-II P, AVT (E)-RAVT (M)-I P, AVT (M)-II P, AVT (M)-R	IVT (E), , IVT (M),
		Agronomy	AS 68, AS 69, AS 70, AS 72(E), AS 72(M)	All	NIL
		Plant Pathology	PP 17A, PP 17B, PP 17D, PP 22, PP 33	PP 17A, PP 17B, PP 17D, PP 22,	PP 33
8.	Shahjahanpur	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72(E), AS 72(M)	AS 68, AS 69, AS 70, AS 72(E), AS 72(M)	AS 71
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 22, PP 23, PP 31	PP 14, ,PP 17A, PP 17B, PP 17D, PP 22, PP 23, PP 31	PP 14A
		Entomology	E 4.1, E 28, E 30, E 38	All	NIL
9.	Sriganga-nagar	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	AS 68, AS 69	AS 70, AS 71, AS 72
10.	Uchani	Plant Breeding	AVT (E)-II P, AVT (E)-R, IVT (M), AVT (M)- I P	All	NIL
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72(E), AS 72(M)	All	NIL
		Plant Pathology	PP 14, PP14A, PP 17A, 17 B, 17 C, PP 17D, PP 22, PP 23, PP 31	PP 14, PP 17A, 17 B, 17 C, PP 17D, PP 22, PP 23, PP 31	PP14A
		Entomology	E 4.1, E 28, E 30, E 38	All	NIL

VISIT SCHEDULE OF THE MONITORING TEAMS DURING 2018-19 CROP SEASON

Monitoring Teams for different zones	Centres to be monitored	Visit schedule
North West Zone		
Team Leader • Dr Neeraj Kulshreshtha, Breeder, SBI-RC, Karnal **Members** • Dr Kuldeep Singh, Agronomist, PAU RRS, Faridkot • Shri S.K. Vishwakarma, Pathologist, UPCSR, Shahjahanpur • Dr V.N Patel, Entomologist, ZARS, Mandya	Lucknow, Shahjahanpur, Muzaffarnagar, Pantnagar, Karnal, Uchani, Kapurthala, Faridkot, Sriganganagar and Kota	28.11.2018 to 08.12.2018
North Central & North East Zone		
Team Leader • Dr Kashinath Mandal, Breeder, SRS, Bethuadahari **Members** • Dr M.K. Tripathi, Agronomist, ICAR-IISR, Lucknow Dr Devanshi Dutta, Pathologist, SRS, Buralikson • Dr Arun Baitha, Entomologist, ICAR-IISR, Lucknow	Gorakhpur, Seorahi, Pusa, Motipur, Muzaffarpur, Bethuadahari and Buralikson	01.12.2018 to 11.12.2018
Peninsular Zone-I		
Team Leader • Dr S.B. Patil, Breeder, ARS, Sankeshwar **Members** • Dr R.K. Meena, Agronomist, ARS, Kota • Dr Dinesh Singh, Pathologist, ICAR-IISR, Lucknow • Dr S.K. Pandey, Entomologist, SBI RC, Karnal	Coimbatore, Pugalur, Thiruvalla, Mandya Sankeshwar, Sameerwadi, Kolhapur and Perumalapalle	04.12.2018 to 13.12.2018
Peninsular Zone-II		
Team Leader • Dr S.C. Mali, Breeder, MSRS, Navsari **Members** • Dr V.P. Jaiswal, Agronomist, ICAR-IISR, Lucknow • Dr Dr M. Minatullah, Pathologist, SRI, Pusa • Dr K.P. Salin, Entomologist, ICAR-SBI, Coimbatore	Pune, Pravaranagar, Padegaon, Akola, Powarkheda, Navsari and Rudrur	27.11.2018 to 08.12.2018
East Coast Zone		
Team Leader • Dr P.K. Nayak, Breeder, SRS, Nayagarh **Members** • Dr Mehar Chand, Agronomist, RRS, Uchani, Kolhapur Dr R.K. Sahu, Pathologist, GBPUA&T, Pantnagar • Mr. R.G. Yadav, Entomologist, VSI, Pune	Nellikuppam, Cuddalore, Vuyyuru, Anakapalle and Nayagarh	29.11.2018 to 07.12.2018

FACILITATOR FOR MONITORING TEAM FOR 2018-2019 CROP SEASON

Sl. No.	Zone	Name & Designation	Contact details
1.	North West Zone	**Shri Adil Zubair,** Asstt. Chief Technical Officer	E-mail: adizubi64@gmail.com Mob.: 07275837686; 09451086378
2.	North Central & North Eastern Zones	**Dr S.K. Awasthi,** Chief Technical Officer	E-mail: awasthi.shashivind.09@gmail.com Mob.: 094159-11964
3.	Peninsular Zone-I	**Dr S.K. Yadav,** Scientist (Agronomy)	E-mail: sanjaybhu05@rediffmail.com Mob.: 094021-34428
4.	Peninsular Zone-II	**Dr Lalan Sharma,** Scientist (Plant Pathologist)	E-mail: sharmanbaim@gmail.com Mob.: 080040-81721; 08887960911
5.	East Coast Zone	**Dr V.K. Gupta,** Principal Scientist (Plant Breeding)	E-mail: drguptavinod57@gmail.com Mob.: 094311-75837; 09919737690

Action Taken Report on the recommendations of the Group Meeting of AICRP on Sugarcane held at the Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) on 22-23 September, 2017 are as under.

S. No.	Recommendation	Action Taken
1.	All the centers will adhere to the name as given by the AICRP(S) while releasing and commercializing the genotypes / varieties, developed and tested through AICRP(S). **(Action: All the centres)**	All the centres are being followed the suggestions given by AICRP(S). The centres will release and commercialize the genotypes / varieties, developed and tested through AICRP on Sugarcane.
2.	Using internet facility by the AICRP(S) centers for digitization of the data recording of AICRP(S) trails. **(Facility of the SAUs/organization may be shared by the centers)**	Almost all the centres have internet facility and are being used for digitization of the data recording of AICRP(S) trials.
3.	A treatment on drought should be regular components in Crop Production trails of AICRP(S) and only newly released varieties should be used in the drought experiments. **(Action: P.I., Crop Production)**	A new trial AS 74: ***"Evaluation of sugarcane varieties for drought tolerance"*** has been initiated for screening of new varieties against drought.
4.	The quarantine protocol must be strictly followed while importing of varieties to tackle the issue on spread of diseases effectively in the country. **(Action: PC(S) to write concerned agencies)**	The Project Coordinator (S) issued the advisory vide letter no. 2-11(Quarantine) / 2018-PCS Dated: 23rd April, 2018 to all concerned agencies for enforcement of the quarantine protocol while importing sugarcane variety seed to tackle the issue on spread of diseases effectively in the country.
5.	Monitoring of trials may be shifted to November/December to have a realistic assessment of the performance of the entries for yield and quality traits. **Action: PC (Sugarcane)**	Accepted and the monitoring teams of AICRP (S) have been constituted for monitoring of the AICRP(S) trials during Nov./Dec., 2018.

Centre-wise / discipline-wise (Scientific/Technical) staff sanctioned during the year 2018-19 to 2019-20 (Current Plan) under AICRP on Sugarcane

Centre	Current Plan (2018-19 to 2019-20)						
	Scientific		Technical				Total (1 to 7)
	Senior Scientist (Rs. 15600-39100; GP Rs. 8000)	**Scientist** (Rs. 15600-39100; GP Rs. 6000)	(Rs. 9300-34800; GP Rs. 4200)	(Rs. 5200-20200; GP Rs. 2800)	(Rs. 5200-20200; GP Rs. 2400)	(Rs. 5200-20200; GP Rs. 1900)	
	1	2	3	4	5	6	7
AICRP(S) Regular Centre							
Anakapalle	Breeder (1)	Pathologist (1) Entomologist (1)	02	01	-	-	**06**
Bethuadahari*	-	Agronomist (1)	01	-	-	-	**02**
Buralikson	Breeder (1)	Pathologist (1)	01	01	-	-	**04**
Cuddalore	Breeder (1)	Pathologist (1)	01	01	-	-	**04**
Faridkot	Breeder (1)	Agronomist (1)	01	01	-	-	**04**
Kapurthala	Breeder (1)	Pathologist (1)	01	01	-	-	**04**
Kolhapur	Breeder (1)	Agronomist (1)	01	01	-	-	**04**
Kota	Breeder (1)	Agronomist (1)	01	01	-	-	**04**
Mandya	Breeder (1)	Entomologist (1)	01	01	-	-	**04**
Navsari	Breeder (1)	Pathologist (1)	01	-	01	-	**04**
Nayagarh	Breeder (1)	Agronomist (1)	01	-	01	-	**04**
Pantnagar	Breeder (1)	Pathologist (1)	01	-	-	01	**04**
Powarkheda	Breeder (1)	Agronomist (1)	01	-	01	-	**04**
Pusa	Breeder (1)	Agronomist (1) Pathologist (1)	01	01	-	01	**06**
Padegaon	Breeder (1)	Entomologist (1)	01	01	-	-	**04**
Sankeshwar	Breeder (1)	Agronomist (1)	-	01	01	-	**04**
Shahjahanpur	Breeder (1)	Agronomist (1) Pathologist (1)	01	01	01	-	**06**
Sriganganagar	Breeder (1)	Chemist (1)	01	-	-	01	**04**
Thiruvalla	Breeder (1)	Pathologist (1) Entomologist (1)	01	02	-	-	**06**
Uchani	Breeder (1)	Agronomist (1) Pathologist (1)	01	-	01	01	**06**
Total	**19**	**25**	**20**	**14**	**06**	**04**	**88**

Scientist: 44 (Breeder: 19, Agronomist: 10, Plant Pathologist: 10, Entomologist: 04 and Chemist: 01)

Technical / Field staff : 44

***At Bethuadahari centre :** Funds are not being remitted. Although 1 scientist and 1 technical are working under AICRP(S).

Centre-wise funds released during 2017-18 of AICRP on Sugarcane

Table A: B.E. / R.E. sanctioned under AICRP (S) for the year 2017-18

(Rs. in lakh)

Sl. No.	Grant in Aid Component	Other than NEH	NEH	Total (2+3)
	1	2	3	4
Budget Estimates				
1.	Grant-in-aid-Salaries	482.00	80.00	**562.00**
2.	Grant-in-aid-General	132.65	0.00	**132.65**
Total		**614.65**	**80.00**	**694.65**
Revised Estimates				
1.	Grant-in-aid-Salaries	836.00	80.00	**916.00**
2.	Grant-in-aid-General	120.65	0.00	**120.65**
Total		**956.65**	**80.00**	**1036.65**

Table B: Funds released to AICRP (S) centres during 2017-18

(Rs. in lakh)

Sl. No.	Name of centre	Pay & allowances	TA & contingencies	Total (2+3)
	1	2	3	4
I. Regular centres				
1	Anakapalle (ANGRAU, Hyderabad)	50.58	6.00	**56.58**
2	Buralikson (AAU, Jorhat)	80.00	0.00	**80.00**
3	Cuddalore (TNAU, Coimbatore)	56.78	4.50	**61.28**
4	Faridkot (PAU, Ludhiana)	41.73	3.00	**44.73**
5	Kolhapur (MPKV, Rahuri)	27.80	3.00	**30.80**
6	Kota (MPUA&T Udaipur)	14.41	3.00	**17.41**
7	Kapurthala (PAU, Ludhiana)	99.18	6.00	**105.18**
8	Mandya (UAS, Banglore)	50.20	4.50	**54.70**
9	Navsari,(NAU, Navsari)	43.62	6.00	**49.62**
10	Nayagarh (OUA&T, Bhubaneshwar)	29.53	4.50	**34.03**
11	Padegaon (MPKV, Rahuri)	37.31	6.00	**43.31**
12	Pantnagar (GBPUA &T, Pantnagar)	41.48	4.50	**45.98**
13	Powarkheda (JNKVV, Jabalpur)	90.66	6.00	**96.66**
14	Pusa (RAU, Samastipur)	41.40	6.00	**47.40**
15	Sankeshwar (UAS, Dharwad)	69.60	4.50	**74.10**
16	Shahjahanpur (UPCSR,U.P.)	47.27	6.00	**53.27**
17	Sriganganagar (RAU, Bikaner)	10.61	3.00	**13.61**
18	Thiruvalla (KAU, Trichur)	42.59	4.50	**47.09**
19	Uchani (CCSHAU, Hisar)	41.25	6.00	**47.25**
Total		**916.00**	**87.00**	**1003.00**
II. Voluntary centres				
1	G.S. Sugarcane Breeding & Research Institute (UPCSR) Seorahi (U.P.)	-	2.00*	**2.00**
2	Vasantdada Sugar Institute, Pune (M.S.)	-	2.00*	**2.00**
3	Sugarcane Research Station,Vuyyuru, Distt. Krishna (A.P)	-	1.50*	**1.50**
4	Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.)	-	1.50*	**1.50**
5	Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh).	-	1.50*	**1.50**
Total			8.50*	**8.50**
Grand total (I + II)		**916.00**	**95.50**	**1011.50**
***Funds released under contingencies.**				

Contact details of Regular and Voluntary Centres under AICRP (Sugarcane) in different zones

Name of Centre full address	Incharge / Address	Contact No./ E-mail
A. NORTH WEST ZONE		
1) Faridkot	Dr. Pankaj Rathore, Director, PAU Regional Station, Faridkot - 151 203 (Punjab) (PAU, Ludhiana)	Phone No.: 01639-251244; Fax : 01639-256949 Mob: 094640-51995 E-mail: rsdirector-faridkot@pau.edu; kuldeep@pau.edu
2) Kapurthala	Dr. Paramjit Singh, Director, PAU Regional Research Station, Kapurthala – 144 601(Punjab) (PAU, Ludhiana)	Mob: 098146-93189 E-mail: director-kapurthala@pau.edu
3) Karnal	Dr. N. Kulshreshtha, Pr. Scientist & Head, Sugarcane Breeding Institute Regional Centre, P.B.No. 52, Karnal (Haryana) – 132 001 (ICAR-SBI, Coimbatore)	Phone No.: 0184-2268096; Fax : 0184-2265723 Mob: 093153-82163 E-mail: headsbirc@gmail.com; kulshreshthan@yahoo.com
4) Shahjahanpur	Dr. J. Singh, Director, U.P.Council of Sugarcane Research, Shahjahanpur – 242 001	Phone No.: 05842-222509 / 222102 Mob: 094550-38993 Fax : 05842-222509 E-mail: dirupcsr@gmail.com; jyotsnendra@ yahoo.com
5) Pantnagar	Prof. S.P. Singh, Deptt. of Genetics & Plant Breeding, G.B. Pant University of Agriculture & Technology, Pantnagar – 263 145, Distt. U.S. Nagar	Phone No.: 05944-233075; Fax : 05944-233473 Mob: 094111-60075 (Dr. S.P. Singh): 075002-41511 (Dr. A.S. Jeena) E-mail: panwar588@gmail.com; dr.asjeena@ gmail.com
6) Sriganganagar	Dr. B.R. Godara, Professor (Soil Science) & Incharge, Agricultural Research Station, Sriganganagar – 335 001 (Rajasthan) (SKRAU, Rajasthan)	Phone No.: 0154-2440619; Fax : 0154-2440703 Mob: 094131-55287 E-mail: balram.g.ars@gmail.com
7) Muzaffarnagar*	Dr. Viresh Singh, Joint Director, Sugarcane Research Station (UPCSR), Muzaffarnagar – 252 001 (U.P.)	Phone/Fax No.: 0131-2621143 Mob: 063890-25341 E-mail: viresh63@gmail.com
8) Kota	Dr. N.R.Koli, Assoc. Prof.(PB&G) & Project Incharge, Agricultural Research Station Ummedganj, P.B. No. 7, GPO – Nayapura, Kaithoon Road, Kota – 324 001 (Rajasthan) (AU, Kota)	Phone No.: 0744-2844369 (O); Fax : 0744-2844306 Mob: 094135-30031 E-mail: arskota@hotmail.com; nanag70@ yahoo.co.in
9) Lucknow	Dr. A.D. Pathak, Director, ICAR-Indian Institute of Sugarcane Research, Rae Bareli Road, Lucknow – 226 002	Phone No.: 0522-2480726; Fax : 0522-2480738 Mob: 094503-735650 E-mail: pathakashwani@ rediffmail.com; director.sugarcane@icar.gov.in
10) Uchani	Dr. Samar Singh, Regional Director, Regional Research Station, (CCSHAU), Uchani – 132 001, Karnal (Haryana) (CCSHAU, Hisar)	Phone 0184-2267857; Fax : 0184-2267499 Mob: 09991-130914 E-mail: rrsuchani@gmail.com; samar9149@rediffmail.com
B. NORTH CENTRAL & NORTH EASTERN ZONE		
1) Seorahi*	Dr. Y.P. Bharati, Scientific Officer & Incharge, G.S. Sugarcane Breeding & Research Institute, Seorahi, Distt. Kushinagar (U.P.)	Mob: 08795837165; 094504-75751 (Dr K. Nand, Breeder) E-mail: gssbriseorahi@gmail.com

2)	Pusa	Dr. S.S. Pandey, Director, Sugarcane Research Institute (RAU), Pusa – 848 125, Distt. Samastipur (Bihar)	Phone No.: 06274-240221; Fax : 06274-240255 Mob: 094304-89230 E-mail: dssripusa12@gmail.com
3)	Motipur	Dr. A.K. Mal, Pr. Scientist & Incharge, IISR Regional Centre, Motipur – 843 111, Distt. Muzaffarpur (Bihar)	Phone/Fax : 06223-234261 Mob: 080090-52220 E-mail: ashutoshkumarmal@gmail.com
4)	Bethuadahari	Dr Kashinath Mandal (Head), Economic Botanist VII, Sugarcane Research Station, Bethuadahari – 741 126 Distt. Nadia (W.B.)	Phone No.: 03474-255353 Mob.: 080164-12906 091536-01588 (Goutam) E-mail:srsbethuadahari@gmail.com; kashinath_pars@yahoo.com; goutamab.srs@gmail.com
5)	Buralikson	Dr. Bijnan Bordoloi, Chief Scientist & Incharge, Sugarcane Research Station (A.A.U.), Buralikson, P.O. Baruabamungaon – 785 618 Distt. Golaghat (Assam)	Phone No.: 03774-279627 Mob. 09435246414 E-mail: bijnan57@gmail.com
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2)	Thiruvalla	Dr. V.R. Shajan, Professor (Plant Breeding) & Head, Sugarcane Research Station, Kallungal, Thiruvalla – 689 101 (Kerala)	Phone No.: 0469-2604181 Mob. 098473-27630 E-mail: srsthiruvalla@kau.in; shajanvr@gmail.com
3)	Mandya	Dr S.N. Swamy Gowda, Sugarcane Breeder & Head (AICRP on Sugarcane), Zonal Agricultural Research Station, V.C. Farm, Mandya – 571 405	Phone No.: 08232-277147; Fax : 08232-277392 Mob. 093411-56455 E-mail: swamygowdavcf@gmail.com
4)	Kolhapur	Dr R.R. Hasure, Agronomist & I/C, Regional Sugarcane & Jaggery Research Station., Opp. Shri Shahu Market Yard, Kolhapur – 416 005	Phone No.: 0231-2651445; Fax : 0231 - 2693017 Mob : 09881981663 E-mail: rsjrs_kpr@rediffmail.com; rajaramhasure63@gmail.com
5)	Sameerwadi*	Dr V.C. Patil, Director, K.J. Somaiya Instt. of Applied Agril. Res. Sameerwadi, Distt. Bagalkot – 587 316 (Karnataka)	Phone No.: 08350-260046/47/48 Mob: 070222-60486 Fax : 08350-260037 E-mail: patil.vc@somaiya.com
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7)	Perumalapalle*	Dr. M. Hemanth Kumar, Principal Scientist (Plant Breeding) & Head, Agricultural Research Station, Perumalapalle, Tirupathi – 517 505 Distt. Chitoor (A.P.)	Phone No.: 0877-2276240 (O) Mob. 098496-41015 E-mail: arsperumallapalle@gmail.com; hemanthangrau@gmail.com
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D.	**PENINSULAR ZONE II**		
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E.	**EAST COAST ZONE**		
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2)	Anakapalle	Dr. P. Jamuna, Associate Director of Research, Regional Agril. Research Station, (ANGR Agril. University), Anakapalle – 531 001 (A.P.)	Phone No.: 08924-223370; Fax : 08924-224021 Mob: 099896-25211 E-mail: adr_rars_akp@yahoo.com; principalscientist.angrau@gmail.com
3)	Vuyyuru*	Dr. K. Jhansi, Principal Scientist (Entomology) & Head, Sugarcane Research Station, (ANGR Agril. University), Vuyyuru – 521 165 Distt. Krishna (A.P.)	Phone/Fax : 08676-233236 Mob: 09849554247 (Dr K. Jhansi) (9248838628 - Dr. V. Satya Priya Lalitha) E-mail: srsvyr@yahoo.com; jhansi_kammili5@hotmail.com
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5)	Nellikuppam*	Dr A. Lourdusamy, Head, Research & Development Centre, E.I.D. Parry (India) Ltd. Keel Arugunam Road, Nellikuppam – 607 105 Distt. Cuddalore (T.N.)	Phone No.: 04324- 270528 Fax : 043242-70219 Mob: 099401-20780 E-mail: lourdusamya@parry.murugappa.com

*Voluntary Centres

Visits of AICRP(S) centres – at a glance

PAU RS, Kapurthala

ARS, Sriganganagar

ARS, Kota

GBPUA&T, Pantnagar

SRI, Pusa

GBBSRI, Seorahi

IISR-RC, Motipur

vf[ky Hkkjrh; lefUor xUuk vuqla/kku ifj;kstuk

All India Coordinated Research Project on Sugarcane

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