अखिल भारतीय समन्वित गन्ना अनुसंधान परियोजना

All India Coordinated Research Project on Sugarcane

Project Coordinator's Report

2015-16

Dr. S K Shukla

Project Coordinator

भाकृअनुप-भारतीय गन्ना अनुसंधान संस्थान, लखनऊ-226002

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Preface

Agriculture plays a vital role in India's economy. A major share (54.6%) of the population is engaged in agriculture and allied activities. As per the latest land use statistics, the contribution of net sown area (139.9 m ha) is 42.56% of the total geographical area (328.7 m ha) of the country. However, the gross cropped area has been estimated at 194.4 m ha because of 138.9% cropping intensity. Still, net irrigated area (66.1 m ha) at the country level is 47.24% of the net sown area. Sugarcane is the main cash crop and grown in both tropical and sub-tropical regions of the country. It is main source of sugar, *gur* and *khandsari* and also provides raw material for manufacturing alcohol. It is also an efficient substitute for petroleum products and other chemical products. It is a long duration crop and requires 10 to 15 months and even 18 months to mature depending upon the geographical conditions. At present, sugarcane is commercially cultivated on 5.04 mha of area with a productivity of 70.5 tonnes/ha in India.

The sugar productionin the 2015 16 is estimated 26 million tonnes (mt). Maharashtra, the country's leading sugar producing state, has estimated sugar output 8.6 mt. Uttar Pradesh is country's second-largest sugar producer and sugar productionis estimated 7.2 mt and continued to keep the country self-reliant in the sugar sector. However, the global market forces brought down the price of sugar considerably, leading to economic losses in mills and non-payment/untimely payment of cane price to the growers. Recently, Govt. of India has allowed 10% blending of ethanol in petrol. If such a decision is brought to practice, there will be higher demand of ethanol in the country. Distilleries linked to sugar mills are proposing to make ethanol from B-heavy molasses so as to reduce sugar production and increase ethanol production. Under such a situation, the demand of sugarcane may also increase. The research efforts under the shifting paradigm will continue to develop high yielding and high sucrose varieties.

All India Coordinated Research Project on Sugarcane is coordinating research work in the country 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 centers and 14 voluntary centers for conducting research and multilocation testing of technology for wider adoption. As per the mandate, the main emphasis is laid on the development of improved sugarcane varieties, crop production and protection technologies suited to commercial cultivation under different agro-climatic conditions in the country. Some sugar factories are also voluntarily involved in the AICRP programme for conducting on-farm trials to evaluate the performance of varieties of sugarcane.

So far, total 117 genotypes have been identified under AICRP on Sugarcane and out of these, 55 genotypes have been released and notified for cultivation in different parts of the country. Two varieties, CoPb 08212 (early) and CoP 09437 (midlate) were identified in 2015 for North West Zone and North Central Zone, respectively. CoPb 08212 is moderately resistant to red rot, smut and wilt and less susceptible to early shoot borer and stalk borer and moderately resistant to top borer. Similarly, CoP 09437 is moderately resistant to red rot, smut and wilt and less susceptible to early shoot borer and top borer. In peninsular zone, Co 09004 was identified as the qualifying entry which recorded 17.89% and 17.84% improvement over the best standard CoC 671 for sugar and cane yields respectively. Genotypes, CoA 11321 and CoA 11323 were identified as the qualifying entries which showed more than 10% improvement for cane yield and were numerically superior to the best standard under early maturing group in the East Coast Zone. Total 24.63 kg fluff from the crosses made at ICAR-SBI, Coimbatore was supplied to the 23 participating centers. Under the project "Evaluation and identification of climate resilient ISH and IGH genetic stocks", 15 entries were evaluated for tolerance to drought in four locations (Padegaon, Anakapalle, Farikot and Karnal).

Besides, production technologies such as subsurface drip irrigation for optimizing resource use efficiency and increasing productivity of sugarcane, use of organics in nutrient management schedule for sustaining soil fertility and crop productivity, ethrel application for enhancing germination and growth of sugarcane have been developed. In protection technologies, differential host studies to identify variation in red rot were conducted at 12 centres in four zones with 88 new isolates along with designated pathotypes. A number of variants have been isolated from the popular varieties such as Co 89003, CoJ 64, CoLk 8102, CoS 8436, CoSe 92423, CoSe 95422, CoC 24 and CoV 09356. About 15 centres have carried out red rot testing, 14 for smut and 5 have screened the clones for wilt resistance. Large numbers of entries were identified as R/MR to red rot, smut and wilt from all the four zones. Clean seed programme initiated after virus elimination through tissue culture combined with molecular diagnosis was found to be effective to rejuvenate degenerated sugarcane varieties. Sugarcane crop raised through clean seed nurseries recorded more than 25 tonnes cane yield per hectare.

The high incidence of whitefly, web mite, root borer and Pyrilla was reported in different varieties in North Western Zone, whereas severe incidence of the Early shoot borer and Internode borer was observed in Peninsular zone. The egg parasitoids. *Trichogramma chilonis*; larval parasitoods *Stenobracon nicevillae, Rhaconotus* scirpophagae. *Isotima javensis, Sturmiopsis inference,Cotesia flavipes* and nymphal and adult parasitoid, *Fulgoraecia melanoleuca* were observed in different zones.

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 centers – Indian Institute of Sugarcane Research, Lucknow and Sugarcane Breeding Institute, Coimbatore. The salient research achievements of 2015-16 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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1. CROP IMPROVEMENT

Development and release of improved varieties are essential for sustaining sugar and sugarcane production of the country. National varietal development programme which is co-ordinated by All India Co-ordinated Research Project on Sugarcane (AICRP-S) is mainly responsible for development of new varieties for the whole country. Twin objectives of AICPR(S) are Fluff Supply Programme involving 24 sugarcane breeding centres and Zonal Varietal Trials (ZVT) conducted in 39 sugarcane research stations located in five different agro-climatic zones. National Hybridization Garden operating at ICAR-Sugarcane Breeding Institute, Coimbatore is responsible for fluff supply programme wherein desired and specific crosses are made for each centre and the crossed fluff are sent to the respective centres for generation of variability and initiating location specific varietal development programme. Elite clones selected by these 24 sugarcane breeding centres and later accepted in the AICRP(S) workshop are pooled zone-wise and tested under Zonal Varietal Trials. This gives an opportunity to test the clones developed by one centre by all other centres of the zone. Thus, AICRP(S) provides a common platform for exchanging and evaluating elite clones developed by different participating centres within each zone. In ZVT the clones are tested for one year in Initial Varietal Trial (IVT) and superior clones are promoted to Advanced Varietal Trials (AVT) and tested for two years in two plant and one ratoon crops. Based on the performance of entries in AVT for cane yield, juice quality and resistance to biotic and abiotic stresses in each zone, the best performing entries are initially identified by Varietal Identification Committee of AICRP(S) and further notified by Central Subcommittee on Crop Standards Notification and Release of Varieties for Agricultural Crops, for general cultivation. The salient findings under the crop improvement programmes of AICRP(S) during 2015-16 are summarized below.

Weather, pests and diseases situation:

Rainfall during the year 2015-16, was deficient in many centres especially which were located in Maharashtra state. However, Cuddalore received unusual excess rainfall. The lowest rainfall was reported by Pravaranagar (357.27 mm) followed by Padegaon (496.5 mm) and Rudrur (518.5 mm) and the highest rainfall was received at Cuddalore (2569.5 mm). Perumalapalle in peninsular zone recorded the maximum temperature of 46.8°C during May, 2015 and Muzzafarnagar in North West Zone recorded the lowest temperature (6.0 °C) during January, 2016. No major disease was reported by the centres. However, Mandya centre reported heavy incidence of Yellow Mosaic Virus, Perumalapalle reported wilt, smut and rust, and Pusa centre observed red rot, wilt and pokkah boeng. Minor incidence of ESB, INB, WWA, mealy bugs, top borer, root borer and termite had been reported by some centres. Pusa centre reported black bug. 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	-
Total	**39**	-	-

Trials conducted and the number of entries evaluated:

A total of 25 Zonal Varietal Trials (14 in early and 11 in mid-late) were conducted during the year 2015-16. There were 8 IVT and 17 AVT trials. A total of 66 entries in early group and 73 entries in mid-late group were evaluated, of which 15 in early and 13 in mid-late 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	3+3	-	Co 09004	-
AVT Ratoon	3+3	-	Co 09004	-
Pooled analysis	3+3	-	Co 09004	-
AVT I Plant	8+3	11+2	Co 10027, CoT 10367, Co 10005	-
IVT	12+3	15+2	-	VSI 12121, Co 12009
Total entries	**23**	**26**	**4**	**2**

Zone / Trials	No. of clones + standards		Promising clones	
	Early	Midlate	Early	Midlate
East Coast Zone				
AVT II Plant	4+3	-	CoA 11321, CoA 11323	-
AVT Ratoon	4+3	-	CoA 11321, CoC 11336	-
Pooled analysis	4+3	-	CoA 11321, CoA 11323	-
AVT I Plant	5+3	-	CoA 12333	-
IVT	8+3	8+3	CoA 13324	CoA 122324, CoC 13339
Total entries	**17**	**8**	**5**	**2**
North West Zone				
AVT II Plant	3+2	5+3	CoS 10231, CoH 10261	CoH 10262, CoPb 10181
AVT Ratoon	3+2	5+3	CoS 10231	CoH 10262, CoPb 10181
Pooled Analysis	3+2	5+3	CoS 10231	CoH 10262, CoPb 10181
AVT I Plant	4+2	6+3	CoLk 11203	-
IVT	10+2	15+3	-	Co 12028, CoS 12232
Total entries	**17**	**26**	**3**	**4**
North Central & North East Zone				
AVT II Plant	-	3+3	-	-
AVT Ratoon	-	3+3	-	-
Pooled Analysis	-	3+3	-	-
AVT I Plant	4+2	4+3	CoSe 11453, CoSe 11454	CoP 11438, CoSe 11451, CoP 11437
IVT	5+2	6+3	CoSe 12453	CoLk 12208, CoP 12437
Total Entries	**9**	**13**	**3**	**5**
Grand total (Entries)	**66**	**73**	**15**	**13**

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

Qualifying entries in different trials

Zone	Trial	Entries
Peninsular zone (Polled data)	AVT – Early (Two plant + one ratoon crops)	Co 09004
East Coast Zone (Polled data)	AVT – Early (Two plant + one ratoon crops)	CoA 11321 CoA 11323

The entries which recorded 10% improvement for cane yield and numerically superior/on par for juice sucrose% compared to the best standard 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 peninsular zone, Co 09004 was the qualifying entry based on the mean performance in two plant and one ratoon crops under early maturing group. CoA 11321 and CoA 11323 were the qualifying entries based on the mean performance in two plant and one ratoon crops under early maturing group in East Coast Zone.

Fluff Supply Programme

Six hundred eleven parental clones were planted in National Hybridisation Garden including 27 new parental clones contributed by Pusa, Lucknow, Pune, Shajahanpur, Seorahi, Sankeshwar, Faridkot and Anakapalle. Twenty three centres made 473 station crosses and 17 selfs. In addition, 32 proven crosses for four different zones, 219 general collections and 21 poly crosses were also made. Maximum quantity of fluff was sent to North West Zone (8.51 kg) followed by Peninsular Zone (6.62 kg), North Central Zone (5.90 kg) and East Coast Zone (3.61 kg). Totally, 24.63 kg of fluff from the crosses made at ICAR-SBI, Coimbatore during 2015 flowering season was supplied to the 23 participating centres. Besides, 2.28 kg of fluff of 106 bi-parental crosses and 20 general collections made at National Distant Hybridization Facility (NDHF), ICAR-SBI, Research Centre, Agali was also supplied to Mandya, Navsari, Pune, Preumalapalle, Rudrur, Sankeshwar, Anakapalle, Nayagarh, Faridkot, Kapurthala, Lucknow, Pantnagar, Shahjahanpur, Uchani, Motipur, Pusa and Seorahi centres. Altogether 26.91 kg of fluff was sent to the participating centres.

Crosses made by the participating centres and the fluff (g) despatched from NHG during 2015-16

Zone	Station crosses and selfs*		Zonal crosses		Poly-crosses		General collections		Total quantity of fluff (g)
	No.	Fluff weight	No.	Fluff weight	No.	Fluff weight	No.	Fluff weight	
Peninzular	161	2872.0	7	436.5	13	876.0	116	2433.0	6617.5
East Coast	75	1421.5	8	484.0	13	367.0	57	1332.5	3605.0
North West	160	2781.5	6	375.0	8	237.5	166	5115.3	8509.3
North Central & North East	77	1406.5	11	605.0	8	168.0	114	3717.2	5896.7
Grand total	473	8481.5	32*	1900.5	21*	1684.5	219*	12598.0	24628.5
Aglai	106	1932.0	-	-	-	-	20	350.5	2282.5
Coimbatore and Agali	579	10413.5	32*	1900.5	21*	1648.5	239*	12948.5	26911.0

* Excluding duplicates

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

Response of traits to drought

Fifteen ISH/IGH clones were evaluated under drought conditions by withdrawing irrigation between 60 and 150 days after planting at four locations *viz*., Padegaon, Anakapalle, Karnal and Faridkot. Percentage of increase/decrease between grand means of the entries under normal and drought induced plots ranged between 0.33 (juice brix % at 300 days) to -18.10 (number of shoots (000'/ha) at 150 days). Eight traits *viz*., juice brix % at 300 days, juice sucrose % at 300 days, cane fibre % at 300 days, juice extraction % at 360 days, juice brix % at 360 days, juice sucrose % at 360 days, cane fibre % at 360 days, tillers mortality (%) showed less than 5% increase/decrease hence these traits were less sensitive to the drought. The most sensitive traits to drought were number of tillers at 90 days (000'/ha), number of shoots at 150 days (000'/ha), cane yield (t/ha) at 360 days and leaf area (m^2) after drought period (150 days) as they recorded more than 15% difference between grand mean of the entries under normal and drought plots.

Response of entries to drought

Fifteen entries were analysed individually for different cane yield, juice quality and drought related traits for their response to drought. The entries which showed less than 5% reduction under drought were identified as tolerant clones. In general juice quality traits viz., juice brix % at 300 and 360 days, juice sucrose % at 300 and 360 days and cane fibre % at 300 and 360 days were less influenced by drought stress as more than 10 entriess showed less reduction (<5%). In addition 13 entries each showed <5% reduction for leaf area (m^2) after drought period (150 days) and relative water content after drought period (150 days) hence they were also insensitive to drought. Analysis of yield contributing traits indicated that AS 04- 2097, SA 04-472, SA 04-472 for single cane weight (kg) at 360 days, GU 07-2276 for number of shoots at 150 days (000'/ha), BM 1022173, SA 04-472, AS 04-2097, MA 5/5 for tillers mortality (%), AS 04-1687, AS 04-2097, GU 07-3849, CYM 07-986 for number of internodes at 360 days and BM 1022173, SA 04-409, AS 04-635, AS 04-1687, CYM 07-986 for number of millable canes at 360 days (000'/ha) were found to be showing <5% reduction. The complex character cane yield showed considerable reduction under drought, however the entries SA 04-409 (-7.94%), AS 04-1689 (-12.45%), AS 04-2097 (-13.08%), GU 07-2276 (-13.64%) and SA 04-472 (-13.87%) recorded <15% reduction.

Juice quality parameters were less affected by drought and number of tillers at 90 days (000'/ha), number of shoots at 150 days (000'/ha), cane yield (t/ha) at 360 days and leaf area (m^2) after drought period (150 days) were more sensitive to drought. Considering cane yield, juice quality and other physiological parameters, four entries *viz*., SA 04-409, AS 04-2097, GU 07-2276 and SA 04-472 were found to be tolerant to drought.

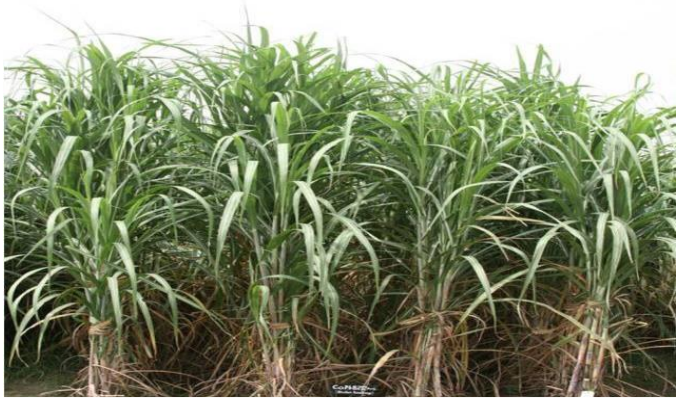
Salient achievements of Crop Improvement

- Twenty five Zonal Varietal Trials (14 in early and 11 in midlate) were conducted during the year 2015-16.
- A total of 66 entries in early group and 68 entries in midlate group were evaluated of which 15 in early and 13 in midlate were found to be promising.
- Qualifying entries were identified based the entries which recorded 10 % improvement for cane yield and numerically superior/on par for juice sucrose % compared to the best standard or an entry which recorded 5% improvement for juice sucrose % and numerically superior/on par for cane yield.
- In peninsular zone, Co 09004 was identified as the qualifying entry which recorded 17.89% and 17.84% improvement over the best standard CoC 671 for sugar and cane yields respectively and was numerically superior to the best standard for sucrose under early maturing group.
- CoA 11321 and CoA 11323 were identified as the qualifying entries which showed more than 10% improvement for cane yield and were numerically superior to the best standard under early maturing group in East Coast Zone.
- Under fluff supply programme, six hundred eleven parental clones were planted in National Hybridisation Garden including 27 new parental clones supplied by Pusa, Lucknow, Pune, Shajahanpur, Seorahi, Sankeshwar, Faridkot and Anakapalle.
- Twenty three centres made 473 station crosses and 17 selfs. In addition, 32 proven crosses for four different zones, 219 general collections and 21 poly crosses were also made.
- Maximum quantity of fluff was sent to North West Zone (8.51 kg) followed by Peninsular Zone (6.62 kg), North Central Zone (5.90 kg) and East Coast Zone (3.61 kg). Totally, 24.63 kg of fluff from the crosses made at ICAR-SBI, Coimbatore was supplied to the 23 participating centres.
- Crosses were made at National Distant Hybridization Facility (NDHF), ICAR-SBI, Research Centre, Agali and 2.28 kg of fluff of 106 bi-parental crosses and 20 general collections were supplied to Mandya, Navsari, Pune, Preumalapalle, Rudrur, Sankeshwar, Anakapalle, Nayagarh, Faridkot, Kapurthala, Lucknow, Pantnagar, Shahjahanpur, Uchani, Motipur, Pusa and Seorahi centres.
- Under the project “Evaluation and identification of climate resilient ISH and IGH genetic stocks” 15 entries were evaluated for tolerance to drought in four locations (Padegaon, Anakalappe, Farikot and Karnal).
- Results indicated that juice quality parameters were less affected by drought and number of tillers at 90 days (000’/ha), number of shoots at 150 days (000’/ha), cane yield (t/ha) at 360 days and leaf area (m2) after drought period (150 days) were more sensitive to drought.
- Considering cane yield, juice quality and other physiological parameters, four entries viz., SA 04-409, AS 04-2097, GU 07-2276 and SA 04-472 were found to be tolerant to drought.

Sugarcane Varieties Identified for Release

A meeting of Varietal Identification Committee was held at the Krishi Bhavan, New Delhi on 10th March, 2016. Two varieties CoPb 08212 (early) for North-West Zone (proposed by Punjab Agricultural University, Ludhiana) and CoP 09437 (Mid-late) for North Central & North East Zones (proposed by GB Pant University of Agriculture & Technology, Pantnagar) were identified for release. Salient features of these varieties are as follows:

(i) **CoPb 08212 :** Moderately resistant to red rot, smut & wilt and less susceptible to early shoot borer and top borer and early maturing variety. At 10 months stage, sucrose content-18.03% and sugarcane yield level-79.07 t/ha.



Early maturing sugarcane variety CoPb 08212

(ii) **CoP 09437 :** Moderately resistant to red rot, smut & wilt and less susceptible to early shoot borer and stalk borer & moderately resistant to top borer and mid-late maturing variety. At 12 months stage, sucrose content-17.60% and sugarcane yield level-76.85 t/ha.

Mid-late maturing sugarcane variety CoP 09437

2.

2. CROP PRODUCTION

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 technologies for sugarcane cultivation. During the crop season 2015-16 four trials (experiments) were conducted as per the pre-decided technical programme. These were concentrated on aspects such as agronomic evaluation of promising genotypes for their performance potential under varying fertility levels, efficacy of sub-surface drip method of irrigation in saving of water and raising of crop yield, integrated nutrient management schedule for sugarcane production system to ensure soil health and crop productivity and also to assess the effect of plant growth regulators on germination, growth and cane and sugar productivity. The centres carried out these trials which were also monitored by monitoring team and the results were reported as per the prescribed format. Akola centre reported some constraints like scarcity of irrigation water and could not conduct the trials. A summary table showing list of centres allotted and status of conducted or skipped the stipulated experiments during 2015-16 has been given in Appendix I.

The experiment wise summary of the results are presented below:

AS 42 : Agronomic Evaluation of Promising Sugarcane Genotypes

This is a continuing trial which was initiated during 2007-08. It was conducted for three years with one set of genotypes, thereafter genotypes were changed and continued further. From the cropping season 2012-13, the trial is being conducted only in one season and will be concluded after taking two plant crops and one ratoon. This trial was allotted to all 25 centres. Out of that, 20 centres conducted it except five centres namely Kolhapur, Akola, Sriganganagar, Mandya and Bethuadhari.

NORTH WEST ZONE

1. FARIDKOT

Among early genotypes CoH 10261 was significantly better in cane yield (107.7 t/ha), however, sucrose % was the highest in Co 10035 (16.22) followed by CoJ 64 (15.87) and was significantly better than CoH 10261 (14.43).There was increase in cane yield up to 125% recommended N but statistically significant increase was there with 100% recommended N.

In mid-late group CoPb 10181 was significantly better in cane yield (120.9 t/ha) than CoS 8436 (76.1 t/ha) and CoPb 10182 (96.3 t/ha). Sucrose % was at par in all the genotypes. There was increase in number of millable canes and cane yield up to 125% recommended N but statistically significant increase was there with 100% recommended N.

2. KOTA

Among genotypes, CoPb 09181produced significantly higher millable cane (130770/ha) and cane yield (102.78 t/ha) over CoH 09264, CoH 09262 and CoLK 09202 and at par with CoPK 05191. Yield attributes, cane yield (85.20 t/ha) and cane

quality increased significantly up to 100% of the recommended dose of N fertilizer in different genotypes.

3. KAPURTHALA

Genotype Co 0118 and CoPb 08212 among early genotypes recorded the higher cane yield while for pol (%) these were close to CoJ 64 which recorded the highest pol(%). For mid-late maturity CoPb 08217 recorded the highest cane yield being significantly better than the check Co 0238 and CoPb 11214, and was comparable to CoPb 91. The pol % of CoPb 08217, Co 0238 and CoPb 91 was at par among each other and was significantly higher than CoPb 11214. Fertilizing the crop with 100% recommended dose of nitrogen *i.e.* 150 kg N ha^{-1} significantly improved cane yield over 75% of the recommended dose of nitrogen but was at par to 125% of the recommended dose of nitrogen.

4. LUCKNOW

The performance of three early genotypes of sugarcane to three levels of fertilizer doses on plant growth, cane yield and its attributes and juice quality were assessed. Genotype CoPb 08217 was found superior over CoLk 09204 and CoS 0835 in respect of cane and ratoon yield as well as juice quality. However, genotype CoLk 09204 observed significantly higher shoot count and NMC over the CoPb 08217 in both plant cane and ratoon. Application of 125% recommended dose of fertilizers (RDF) recorded the highest plant growth, shoot counts, NMC, cane and ratoon yield than 75% and 100% RDF but were at par to each other.

5. PANTNAGAR

Among all the genotypes, Co Pant 05224 performed better than rest of the genotypes followed by Co Pant 99214. Cane yield was similar in 100% or 125 % of the recommended dose of N, P and K which were significantly higher over 75 % of the recommended (120: 60: 40 kg of N, P and K per ha). Ratoon crop of genotype Co Pant 05224 performed better in cane yield, juice quality, and cane height and cane girth as compared to rest of the genotypes treatments. Cane yield improved in 125 % of the recommended dose of fertilizers (150: 60: 40 kg of N, P and K per ha) over 100 or 75 % of the RDF.

6. SHAHJAHANPUR

The genotype CoS 07240 gave significantly higher ratoon cane yield (74.9 t/ha) followed by genotype CoS 03261 (55.3 t/ha) and CoS 03251 (46.5 t/ha). Regarding different nitrogen levels, significantly higher ratoon cane yield (65.6 t/ha) was obtained with 125 % of recommended N than that of 75 % and 100% recommended N.

7. UCHANI

In early group, gentype CoLk 09202 produced significantly highest cane (75.1 t/ha) and sugar yield (8.58 t/ha). CoH 09262 recorded significantly higher CCS (12.09%). In mid-late group, genotypes CoP 10231 (77.4, 9.19 t/ha) and Co 10221 (78.8, 9.38 t/ha) being at par produced significantly higher cane yield and sugar yield as compared to variety Co 10036 (71.9, 8.53 t/ha). All the varieties responded up to 25%

higher than recommended dose of nitrogen (187.5 kg/ha) irrespective of their maturity groups.

PENINSULAR ZONE

8. PADEGAON

Among early genotypes Co 09007 was found significantly superior for cane yields and genotype Co 09004 for CCS yield than the other genotypes. Application of 125 % recommended dose of nitrogen produced significantly higher cane yield. While CCS yield was not affected by different nitrogen levels. Genotype Co 09007 with 100% N recorded significantly the highest cane yield (175.73 t ha^{-1}).

For mid-late group Co 10033 was found significantly superior for cane yield and genotype Co 09009 for CCS yield than the other genotypes. The application of 100 % recommended dose of nitrogen produced significantly higher Cane and CCS yields. Significantly the highest brix(c) (28.98%), sucrose (20.19%), CCS (14.34%) and purity (95.40%) was recorded by genotype Co 09009 with 100% RDN.

9. PUNE

Among the genotypes evaluated, significantly higher cane yield (128.24 t/ha), NMC (0.84 lac/ha), B: C ratio (1:2.29) with CCS (13.89 %) was recorded in genotype VSI 08005.Whereas, significantly more tillering at 120 DAP (1.03 L/ha), cane weight (2.01 kg) and cane girth (11.01cm) was obtained in genotype Co 10001. Application of 125% of RDF to *suru* sugarcane produced significantly higher cane yield (110.29 t/ha), CCS yield (14.09 t/ha) & B: C ratio (1:1.94).

10. POWARKHEDA

Results for ratoon crop revealed that among the early genotypes Co 06022 gave significantly higher cane yield of (98.87 t/ha) than Co C 671 (93.20 t/ha) and Co 06002 (88.61 t/ha). Application of 125 % RDF (NPK) gave significantly higher cane yield of (95.88 t/ha) than 75 % RDF NPK (89.74 t/ha) but increase in cane yield was at par between 100 and 125% RDF NPK.

Ratoon crop of mid-late genotype, Co 06027 recorded significantly higher cane yield (107.72 t/ha) than Co 06015 (93.18 t/ha) and Co JN 86-600 (93.45 t/ha), but the cane yield was similar in Co 06027 (107.72 t/ha) and Co 06010 (103.88 t/ha). The cane yield increased with the increasing levels of fertilizer doses. The cane yield was significantly higher with 125% RDF NPK (101.75 t/ha) than 75% RDF NPK (95.70 t/ha). The cane yield recorded with 100 and 125% RDF NPK was at par.

11. NAVSARI

For ratoon of early maturing genotypes significantly highest cane yield (124.10 t ha-1) was noticed with variety CoN 10071 however, it was not significantly influenced due to different fertilizer levels. The ratoon performance of mid-late genotypes reflected that significantly highest NMC (108.15 000 ha-1), cane yield (117.92 t ha-1) and significantly highest CCS yield were recorded with CoN 13073 whereas the fertilizer level (125% RDN) failed to reach the level of significance on

NMC and CCS yield while cane yield (113.74 t ha-1) recorded significantly highest with 125% RDN over F1 and remained at par with F2.

The performance of early and mid-late genotypes in second year plant crop revealed that in early group CoN 10071 recorded significantly highest NMC (111.53 000 ha^{-1} and cane yield (135.97 t ha^{-1}). The fertilizer level F3 recorded significantly higher cane yield (133.65 t ha^{-1}) over F1 but at par with F2. CCS yield was not influenced significantly due to varieties and fertilizer levels. Among mid-late genotypes significantly highest NMC (117.19 000 ha^{-1}) and cane yield (129.34 t ha^{-1}) were recorded with CoN 13073. Significantly highest Cane yield (127.48 t ha^{-1}) was recorded with F2 (100% RDN) over F1 & remained at par with F3 (125% RDN).

12. THIRUVALLA

Among the genotypes studied, CoSnk 08101 recorded maximum values for cane length, cane weight, millable cane count and resulted in reasonably good yield (75.70 t/ha) which was significantly superior to others followed by Co 07008 with an yield of 61.23 t/ha. Similarly, sugar yield was also significantly superior for CoSnk 08101 (9.59 t/ha).The treatment variations due to varying N levels were also significant for growth and yield parameters. The growth and yield of the genotypes recorded with 125% of the recommended dose of N were significantly superior to that obtained with 100% recommended N dose.

13. COIMBATORE

Amongst the early genotypes Co 09004 recorded significantly higher cane height, cane yield (171.89 t/ha) and numerically higher brix (22.03), sucrose % (21.15), purity per cent (93.69) and CCS % (14.67) over the control CoC 671 (145.58 t/ha). In case of mid late genotypes, Co 08009 recorded the highest yield of 177.07 t/ha which was on par with the other mid-late genotypes such as Co 08020 (171.69 t/ha) and Co 86032 (174.90 t/ha). The effect of application of N on cane yield was significant wherein application of 100 and 125 % of recommended dose of nitrogen recorded significantly higher cane yield over 75 % RDN.

14. SANKESHWAR

The higher cane yield & CCS yield was recorded in SNK 088789 and all the quality parameters were superior in Co 9004. Among the fertilizer doses tested there was no impact of variation in doses. Some times higher doses cause impurity in quality and yielding ability of early types. Application of either 75% or 100 % RDF was found suitable, based on soil type and management practices followed.

EAST COAST ZONE

15. ANAKAPALLE

Among the three new mid-late genotypes under test 2004A104 proved superior (68.1 t/ha) to 2007A126 (64.4 t/ha) and 2007A177 (62.4 t/ha) but found on par with the check variety Co 7219 (65.9 t/ha). Application of N at 125% recommended dose recorded significantly higher cane yield of 71.3 t/ha than lower levels of 75% (59.8

t/ha) and 100% (64.6 t/ha) recommended nitrogen. Three years study (two plant crops and one ratoon) on performance of new promising mid late sugarcane genotypes viz., 2004A104, 2007A177 and 2007A126 along with check Co7219 to graded levels of nitrogen in irrigated conditions indicated that, among different sugarcane genotypes (mid-late group) 2007A126 and 2004A104 recorded higher number of millable canes (65,300/ha and 61,800/ha) and cane yield (69.4 t/ha and 68 t/ha). Three tested genotypes performed well and registered higher number of millable canes (65,500/ha), cane yield (72.8 t/ha) and sugar yield (8.9 t/ha) at 125% (140 Kg N/ha) recommended nitrogen. However, the highest mean juice sucrose per cent was recorded at 100% recommended dose of nitrogen.

16. CUDDALORE

The genotype CoC 11336 observed significantly higher number of millable canes, cane weight and cane and sugar yield. Also in the juice quality, the clone CoC 11336 registered the highest commercial cane sugar (CCS) per cent and was on par with the local check CoC 24. Prescription of 125 per cent of the recommended dose of nitrogen registered significantly higher values of yield components, cane and sugar yield as compared to 75% and 100% of recommended doses of nitrogen.

17. NAYAGARH

Genotype CoOr 12346 produced the highest average cane yield of 95.073 t/ha with application of 100% RDN and was closely followed by CoOr 10346 (89.37 t/ha) and CoA 12322 (88.91 t/ha).

NORTH CENTRAL ZONE

18. PUSA

In early group, CoP 14437 significantly out yielded (103.7 t/ha) over rest of the genotypes while in mid-late group, CoP 14439 having cane yield of 101.7 t/ha was significantly superior over rest of the genotypes. Application of 125% recommended dose of nitrogen was found to be optimum for early as well as mid-late genotypes of sugarcane.

19. SEORAHI

Genotype CoSe 11453 produced significantly higher germination, shoot population, number of millable cane and cane yield as compared to varieties CoSe 11451 and CoSe 11454. Cane yield increased up to 125 % recommended dose of fertilizer.

20. BURALIKSON

Among early genotypes, CoBln 14503 recorded significantly the highest number of millable cane (92.97 thousand/ha), cane diameter (2.57cm) and cane yield (67.52 t/ha) than all other genotypes. Among the three fertilizer levels, application of 125% of the recommended dose of NPK recorded significantly the higher cane yield (61.98t/ha). For mid-late maturing genotypes CoBln 14505 recorded the higher cane yield (68.79t/ha) and application of 125% of the recommended dose of NPK recorded

significantly the higher cane yield (62.27/ha). For ratoons, CoBln14503 recorded significantly higher number of millable canes (74.76 thousand/ha) and cane yield (62.28 t/ha) in early group and CoBln 14505 recorded significantly the higher number of millable cane (67.41 thousand/ha) and cane yield (57.58 t/ha) in mid-late group.

Important Observations

North West Zone

As per the experimental results of the centres, Co 118, Co Lk 09202, CoLk 09204,CoH 10261, Co Pant 05224/ Co Pant 99214, Co 10035, Co 08212 and CoH 09262 were found as promising genotypes for the early maturing group, whereas CoP 10221, Co 10231, CoS 07240, CoPb 10181/ 09181/ 91 among mid-late genotypes. Significant response to N ranged from 100-125% of RDN.

Peninsular Zone

Depending on the trials conducted at different centres Co 09004, Co 09007, Co 06022, SNK 088789 and CoN 10071were found promising among early maturing genotypes. Among mid-late genotypes, Co 08009/ 08020/ 10033/ 09009/ 06027/ 06010, VSI 08005, SNK 7680, CoN 13073, CoN 11073 and CoSnk 08101 proved to be superior genotypes. At most of the centres, yield increased significantly up to 125% RDN.

East Coast Zone

In this zone, 2004A104, 2007A126, CoC 11336, CoOr10346 and CoOr 12346, were observed to be promising genotypes. Response to N was observed up to 125% of RDN.

North Central Zone

CoP 14437 in early group and CoP14439 and CoSe 11453 were promising materials responding up to 125% of RDN.

North Eastern Zone

CoBln 14503 among early genotypes andCoBln 14505/ 14504 among mid-late genotypes were found promising and responded up to 125% of RDN.

AS 67: Optimization of fertigation schedule for sugarcane through micro-irrigation techniques under different agro-climatic conditions

1. FARIDKOT

Surface drip irrigation for paired row trench planted sugarcane (120:30 cm) resulted in saving of 48% irrigation water and 20 % of recommended N.

2. LUCKNOW

Highest sugarcane yield of 111.42 t/ha was observed when sugarcane was drip fertigated with recommended dose of nitrogen and water equivalent to 125 % pan evaporation (PE). However, irrigation water use efficiency (IWUE) was the highest at

2265.5 kg/ha-cm when fertigation with recommended dose of nitrogen was done and the amount of irrigation water was kept at 75% of PE.

3. CUDDALORE

Highest sugarcane yield of 139.4 t/ha was recorded with 125% PE for irrigation. However, IWUE was highest at 1477 kg/ha-cm when fertigation was done and the amount of irrigation water was kept as 75% of PE. Among the nitrogen levels, 100% application of nitrogen through sub surface drip fertigation recorded the maximum cane yield (139.8 t/ha).

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

The trial was initiated during the year 2014-15 with allotment to all the centres. However, during the year 2015-16 only 23 centres carried out the trial.

NORTH WEST ZONE

1. FARIDKOT

Cane yield of first ratoon crop was the highest (94.3 t/ha) with application of FYM/compost @ 20 t/ ha + in-organic nutrients based on soil test (T 6) which was significantly higher than other treatments except T_5 (89.9 t/ha), T_9 (86.4 t/ha) and T_4 (84.4 t/ha). These treatments also had the residual effect of FYM applied to the plant crop.

2. LUCKNOW

The significantly the highest stubble sprouts (92.6%) was observed under the treatment of organic application. Highest number of tillers (254.9 thousand /ha) at 120 days after initiation (DAI), shoot count (210.7 thousand/ha) at 180 DAI, number of millable canes (167.9 thousand/ha), cane yield (91.7 t/ha) and sugar yield (11.07 t/ha) were recorded under the treatment where FYM @ 20 t/ha was applied along with soil test (rating chart) based in-organic fertilizer recommendations.

3. PANTNAGAR

Plant cane yield was significantly highest where in FYM @ 20 t/ha + 100 % RDF (120: 60:40 kg NPK/ha) was applied followed by FYM @ 20 ton/ha + inorganic nutrients though soil test based crop response. Higher cane yield in these two treatments could be the effect of higher germination, initial shoot population, NMC, cane girth, cane length and cane weight. Organic carbon was recorded highest through application of FYM 20 ton/ha + inorganic nutrients on soil test based (rating chart). Available N, P and K were also higher with this treatment.

The highest cane yield in first ratoon crop was recorded when FYM was applied @ 20 t/ha + inorganic nutrients applied based on soil test (NPK) followed by FYM applied @ 10 t/ha + bio-fertilizer (*Azotobacter* + PSB) + 100 % RDF (150: 70 + 50 kg). CCS yield was also highest in T_6 followed by T_8. On the basis of soil analysis it was recorded that in general organic carbon, available N, P and K were increased significantly in the treatment T_5 – FYM @ 20 t/ha + 100 % RDF (inorganic sources)

followed by T_4 – FYM @ 20 t/ha + 50 % RDF (inorganic source) and T_6 – FYM @ 20 t/ha + inorganic nutrients applied on soil test (NPK application). Available N, P, K and organic carbon was lowest in T_1 followed by T_2 – (application of trash 10 t/ha + 50 % or 100 % recommended NPK).

4. UCHANI

FYM @ 20 t/ ha + in-organic nutrient application based on soil test in plant crop and ratoon crop (T_6) and application of FYM/Compost @ 20 t/ha + 100% RDF in plant and ratoon crop (T_5) recorded highest number of tillers, millable canes and cane yield in sugarcane plant- ratoon cropping system. Whereas, treatments T_5 and T_6 being at par produced significantly the highest sugar yield among all the treatments.

5. KAPURTHALA

The data revealed that the highest cane yield (93.2 t/ha) was obtained in treatment T_6 when in FYM 20 t/ha was applied along with 100% of RDF, which was significantly higher than the treatments (T_1, T_4& T_7) where 50% RDF was applied alone and also with combination of FYM & bio fertilizer and was also significantly higher than T_2& T_3 where no organic sources was applied.

6. SHAHJAHANPUR

Application of FYM @ 10 t/ha + bio-fertilizers (*Azotobacter* + PSB) + soil test basis NPK (T_9) produced significantly higher ratoon cane yield (98.84t/ha) followed by application of FYM @ 20 t/ha + inorganic nutrient application based on soil test (T_6). Maximum benefit cast ratio (1.96) was also obtained in T_9 treatment.

7. SRIGANGANAGAR

The application of 100% RDF and soil test based fertilizers with FYM @ 20 t/ha (T_6 and T_5) produced significantly higher cane yield over other treatments but at par with each other. The application of bio-fertilizers with FYM @ 10 t/ha and in-organic fertilizers recorded significantly higher cane yield over the application of trash @ 10 t/ha with organic fertilizers.

8. KOTA

Fertilizer application based on soil test (150:50:30 kg N, P_2O_5, K_2O/ha) through in-organic sources enriched with 10 t FYM/ha +12.5 + 12.5kg/ha (*Azotobacter* + PSB) was found effective for increasing cane yield (98.20 and 85.00 t/ha), CCS yield (12.10 and 10.34 t/ha) and net returns(Rs 1,15,660 and 85,376/ha, respectively), during both the years which was significantly superior over T_1,T_4 and T_7 treatments. Whereas, application of 150:50:30 kg N, P_2O_5, K_2O/ha (STB) through inorganic source, enriched with 20 t FYM /ha (T_6) was found significantly superior and next best treatment in respect of growth, quality and for improving fertility status of soil during both the years.

PENINSULAR ZONE

9. THIRUVALLA

Among the various treatments, T_8 (FYM/ compost @ 10 t/ ha + biofertilizer (*Azotobacter*/ *Acetobacter* + PSB) + 100% RDF) recorded significantly higher cane length (250.54 cm), MCC (89000/ha) and resulted in highest plant cane yield (107.22 t/ha). Brix and sugar yield also followed the same trend with significantly higher value for sugar yield (12.30 t/ha) for the very same treatment. It was closely followed by T_6 (FYM/Compost @ 20 t / ha + inorganic nutrient application based on soil test (rating chart)).

10. MANDYA

The data on cane and ratoon yield indicated that, application of FYM @ 20 t/ha + inorganic nutrient application based on soil test recorded significantly higher cane and ratoon yield (96.58 and 90.33 t/ha) compared to all other treatments. However, it was on par with application of FYM @ 20 t/ ha + 100% RDF (93.12 and 88.07 t/ha), application of FYM @ 10 t/ha + bio fertilizer (*Azotobacter*/*Acetobacter* + PSB) + 100% RDF (90.63 and 85.50 t/ha) and application of FYM @ 10 t/ha + bio fertilizer (*Azotobacter*/ *Acetobacter* + PSB) + soil test basis fertilizer application (88.73 and 84.72 t/ha).

11. SANKESHWAR

Nutrient management practices followed with either soil test based NPK application or 100% RDF along with *Azospirillum* +PSB each @ 1 kg and either 10 or 20 t/ha FYM based on the availability was found beneficial for higher cane yield.

12. PADEGAON

Application of recommended dose of fertilizers as per soil test along with 20 t ha^{-1} FYM for pre-seasonal sugarcane was found beneficial in terms of yield, quality and soil health.

13. POWARKHEDA

The cane yield increased significantly due (101.85 t/ha) to application of FYM/ compost @ 20 t/ha + inorganic nutrients based on soil test as compared to application of trash 10 t/ha + 50% RDF (68.62), FYM/ compost @ 20 t/ha + 50% RDF (85.29 t/ha), trash 10 t/ha + 100% RDF (91.67 t/ha) and trash 10 t/ha + Soil test based NPK application (92.59 t/ha).

14. NAVSARI

Significantly, the highest cane yield (123.36 t ha^{-1}) was recorded with T_9 that remained at par with T_5 and T_6. CCS yield (13.61 t ha^{-1}) was also recorded highest with T_9 over T_1 and was at par with all the treatments except T_3. Various quality parameters were influenced significantly due to different nutrient management treatments at 10 months stage of the crop.

15. KOLHAPUR

Different treatments significantly influenced the cane and CCS yield. The treatment T_5 (application of FYM @20 tonnes ha^{-1} + 100% RDF) recorded significantly highest cane and CCS yield (102.2 and 14.83 t ha^{-1}, respectively) which was at par with all the remaining treatments except T_1 and T_2. It was revealed that, the quality parameters were influenced significantly due to various treatments except purity percentage.

16. COIMBATORE

Integrated application of organics and in-organics *i.e.* application of 10 t FYM+ STCR 150+ bio-fertilizer recorded significantly higher NMC and cane yield of 186.46 t/ha over the control (no fertilizer application). Sugarcane juice analysis done at 12 months revealed that application of organics and inorganics Brix, Sucrose, Purity and CCS significantly did not influenced.

17. PUNE

The highest cane yield 150.16 t ha^{-1} was obtained with application of compost @ 20 t ha^{-1} + 100% RDF through in-organic fertilizers followed by the treatments having compost @ 20 t ha^{-1} with in-organic fertilizers based on soil test (149.20 t ha^{-1}). However, application of compost @ 10 t ha^{-1} + bio-fertilizers (*Acetobacter*& PSB) along with 50% RDF (142.12 t ha^{-1}), 100% RDF (143.61 t ha^{-1}) and fertilizers based on soil test (140.96 t ha^{-1}) found at par. All the treatments of inorganic fertilizers along with compost showed significant results over the treatments without organic manure.

EAST COAST ZONE

18. CUDDALORE

In the first ratoon crop the application of FYM @ 10 t/ha + bio fertilizer (*Azotobacter* + PSB) + 100 % RDF recorded significantly higher number of millable canes (1, 30,500 ha^{-1}) and cane yield (140.0 t ha^{-1}). However data on the CCS per cent was not significant due to the various treatments.

19. ANAKAPALLE

The results indicated that application of FYM @ 10 t/ha + bio-fertilizer + in-organic nutrient application based on soil test (95.6 t/ha) or application of FYM @ 10 t/ha+ bio-fertilizer + 100% RDF (95.4 t/ha) observed significantly higher cane yield as compared to the other treatments. Application of 50% RDF registered lowest cane yield of 80.4 t/ha.

20. NAYAGARH

The NMC and Cane yield were 75.88 ’000/ha and 81.87 t/ha in T_7, 76.71’000/ha and 82.73 t/ha in T_8 and 77.52’000/ha and 83.93 t/ha in T_9, respectively. This exhibited the positive effect of organic manures and bio-fertilizers on cane yield. The soil physico-chemical parameters like BD, pH, EC, organic carbon content as well as available N, P and K content exhibited marked improvement upon application of organic sources of plant nutrients.

NORTH CENTRAL ZONE

21. SEORAHI

Application of FYM @ 10 t/ha+ bio-fertilizer *Azotobacter* + PSB + soil test based (NPK application) produced significantly, higher cane yield. Sucrose percent was not affected significantly with different treatments.

22. PUSA

Integrated application of nutrients was found effective in improving soil fertility and ratoon cane yield. The application of fertilizers based on soil test *i.e.* 170 kg N, 50 kg P_2O5 and 80 kg K_2O along with organics @ 20 t/ha was found suitable for improving ratoon cane yield and maintaining soil fertility in calcareous soils of Bihar state.

NORTH EAST ZONE

23. BURALIKSON

Like the plant crop, in the first ratoon crop, application of FYM @10 t/ha along with bio-fertilizer and in-organic fertilizer based on soil test recorded significantly higher cane yield (65.3 t/ha) which was at par with application of FYM @ 10 t/ha along with bio-fertilizer (Azotobacter + PSB) and 100% RDF (64.3 t/ha) and the yield recorded by application of FYM @ 20 t/ha along with soil test based fertilizer (60.5 t/ha), respectively.

Important Observations

Results obtained across the centres revealed that addition of organic manures (FYM or compost) along with bio-fertilizers and recommended nutrients brought about significant enhancement in cane yield over that with application of inorganic fertilizers alone. Better performance under nutrient application based on soil test over that with recommended dose of fertilizers was also evident from the results.

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 to assess the response of sugarcane crop to plant growth regulators for improvement in germination, growth and yield of the crop. The trial was allocated to all the centres however, only 20 centres conducted the trial. Centre wise summary is given below.

NORTH WEST ZONE

1. FARIDKOT

Germination of sugarcane was better with treating the setts by 100 ppm ethrel solution than no treatment. The highest cane yield (82.8 t/ha) was observed in T_8 (planting of setts after overnight soaking in 100 ppm ethrel solution and GA_3 (35 ppm) sprayed at 90, 120 and 150 DAP).

2. KOTA

Planting of setts after overnight soaking in 100 ppm ethrel solution + GA_3 spray at 90,120,150 DAP was found effective for increasing dry matter production, leaf area, root dry weight, NMC (1,45,330/ha), cane weight (857 g), cane yield (98.77 t/ha),^{o} Brix (21.10%), sucrose (18.59%), CCS (12.84%), CCS (12.68 t/ha) and purity (88.09%), GR and NR (Rs 2,46,917 and 1,31,467 /ha) which was significantly superior over T_1 and T_2 treatments.

3. KAPURTHALA

Germination of sugarcane under the treatments, where setts were soaked in water and ethrel solution was significantly better than the treatment where no soaking was done. There was improvement in germination when soaked in ethrel solution than soaking only in water but the differences were non-significant. The highest cane yield (82.8 t/ha) was observed in planting when setts were soaked for overnight in 100 ppm ethrel solution and GA_3 (35 ppm) sprayed at 90, 120 and 150 DAP).

4. LUCKNOW

The experiment on use of plant growth regulators (PGRs) on yield and quality of sugarcane conducted during 2015-16 at IISR, Lucknow revealed that planting of three budded setts after overnight soaking in 100 ppm ethrel solution and GA_3 (35 ppm) spay at 90,120 and 150 days after planting resulted early cane sett germination in sugarcane and enhanced cane yield (96.67 t/ha) over the conventional practice (74.11 t/ha), without affecting the cane juice quality.

5. PANTNAGAR

Germination hastened (20 days earlier than conventional) in case if sugarcane setts being soaked overnight in 100 ppm ethrel. Cane yield and commercial cane sugar yield were higher in the treatment with overnight sett soaking in ethrel @ 100 ppm followed by GA_3 spray @ 35 ppm applied at 90, 120 and 150 DAP.

6. SHAHJAHANPUR

Planting of setts after overnight soaking in 100 ppm ethrel solution + GA_3 (35 ppm) resulted in significantly higher leaf area , root dry weight , plant height , tillers, millable canes and cane yield than that of other treatments. Germination (%) recorded at different stages under overnight soaking in 100 ppm ethral solution were significantly superior to conventional and overnight soaking in water but it was at par with overnight soaking in 50 ppm ethrel solution.

7. UCHANI

Soaking of sugarcane setts in water or 50 ppm or 100 ppm ethrel solutions resulted in significant increase in sugarcane germination, tillers, millable canes and cane and sugar yield over conventional practice. Spraying of GA_3 (35 ppm) resulted in significant increase in number of millable canes, cane and sugar yield in comparison to their untreated treatments.

8. SRIGANGANAGAR

Soaking of sugarcane setts in water or 50 or 100 ppm ethrel solutions resulted in significant increase in sugarcane germination, millable canes and cane yield over farmers/conventional practice. The application of GA_3 (35 ppm) resulted in significant increase in number of millable canes and cane yield as compared to their untreated treatments. The overnight soaking with 100 ppm ethrel solution recorded at par cane yield with 50 ppm ethrel solution.

PENINSULAR ZONE

1. PADEGAON

Planting of setts after overnight soaking in 50 ppm ethrel solution with GA_3 spray (35 ppm) at 90, 120 and 150 DAP (T_7) recorded significantly the highest cane and CCS yields (132.33 and 20.13 t/ha). However, it was at par with planting of setts after overnight soaking in 100 ppm ethrel solution and GA_3 spray (35 ppm) at 90, 120 and 180 DAP (129.07 and 18.90 t/ha), planting of setts after overnight soaking in water with GA_3 spray (35 ppm) at 90, 120 and 150 DAP (126.07 and 18.57 t/ha), planting of setts after overnight soaking in 50 ppm ethrel solution (124.53 and 18.54 t/ha) and planting of setts after overnight soaking in 100 ppm ethrel solution (125.27 and 18.37 t/ha).

2. NAVSARI

Germination (%) was recorded significantly highest with planting of setts after overnight soaking in 100 ppm ethrel solution) over other treatments. Cane length at harvest was recorded significantly highest with treatment T_2 over other treatments and remained at par with T_8, T_6, T_3 and T_7. The highest cane yield (126.03 t ha^{-1}) was observed with planting of setts after overnight soaking in water.

3. MANDYA

Overnight soaking of setts in 50 or 100% ethrel solution followed by 35 ppm GA3 sprayed at 60, 120 and 150 DAP enhanced the germination percentage and cane yield.

4. POWARKHEDA

The cane yield (t/ha) increased significantly due to planting of setts after overnight soaking in 50 ppm ethrel solution (129.22 t/ha) as compared to T_6 (120.37), T_2 (120.68), T_5 (121.50) and conventional planting/Farmers practice (3- bud setts) (121.71).

5. PUNE

The results of the first plant crop indicated that, highest germination (63.66%) at 30 DAP, tillering (1.04 lac/ha) at 120 DAP, NMC (0.73 lac/ha),cane girth (12.08 cm),single cane weight (1.76 kg),CCS (13.75 %), cane yield (137.50 t/ha) and B:C ratio (2.44) was recorded when the setts were overnight soaked in 100 ppm ethrel before planting and foliar spraying of GA_3 (35ppm) at 90,120 &150 DAP followed by cane

yield of 127.50 t/ha in overnight soaking of setts in 50ppm ethrel and spraying of GA_3 (35ppm).

6. THIRUVALLA

The highest germination percentage and tiller population were recorded with T_8 (T_4 +GA_3 spray (35ppm) at 90,120 and 150 DAP) and the lowest value for the above parameters were recorded by T_2 (planting of setts after overnight soaking in water). Highest cane length (256.00 cm), MCC (91450 /ha), cane yield (115.72 t/ha) were recorded under T_8. Sugar yield also showed same trend and recorded significantly higher value (13.38 t/ha) for the very same treatment (T_8). This was closely followed by T_4 (planting of setts after overnight soaking in 100 ppm ethrel solution. BC ratio of 1.40 was also recorded by T_8.

7. SANKESHWAR

The higher germination count, cane height, number of internodes among the growth parameters and higher cane yield, cane girth, NMC, CCS yield and single cane weight among the yield and yield attributing parameters clearly indicates the benefit of overnight soaking of setts in 50 ppm ethrel solution before planting as it was beneficial without altering the quality parameters.

EAST COAST ZONE

8. ANAKAPALLE

Results indicated that significantly higher cane yield was recorded in planting of setts after overnight soaking in 100 ppm (92.0 t/ha) or 50 ppm ethrel solution (90.6 t/ha) followed by spraying of GA_3 at 90,120 and 150 days after planting (90.6 t/ha). Conventional 3 budded sett planting recorded significantly lower cane yield of 80.0 t/ha.

9. CUDDALORE

Adoption of overnight soaking of setts in 100 ppm ethrel solution along with GA_3 (35 ppm) spray at 90, 120 and 150 DAP recorded the maximum millable canes and cane yield.

10. NAYAGARH

Planting of setts after soaking in 100 ppm ethrel solution along with GA_3 spray at 90, 120 and 150 DAP performed better with highest number of millable canes (82.47 th/ha), cane yield (114.45 t/ha) and CCS yield (11.45 t/ha). The treatment next in order was T_7 where planting of setts was done after soaking in 50 ppm ethrel solution along with GA_3 spray at 90, 120 & 150 DAP produced NMC of 81.37 (’000 /ha) with cane and CCS yield of 111.26 and 10.84 t/ha, respectively.

11. PUSA

Planting of setts after overnight soaking in 50 ppm ethrel solution + GA_3 spray (35 ppm) at 90, 120 and 150 DAP (T_7) produced higher cane yield (103.2 t/ha) followed in order by planting of setts after overnight soaking in 100 ppm ethrel solution + GA_3 spray (35 ppm) at 90, 120 and 150 DAP (T_8).

12. BURALIKSON

Planting of setts after overnight soaking in water (T_2), or overnight soaking in 50 ppm ethrel solution (T_3), or overnight soaking in 100 ppm ethrel solution(T_4) significantly increased the germination (%) over conventional planting (T_1). Likewise, in terms of cane yield all the treatments recorded significantly the higher cane yield than conventional planting. Out of all treatments, planting of setts after overnight soaking in 100 ppm ethrel solution followed by spraying of GA_3 (35ppm) at 90,120 and 150 DAP recorded significantly the highest cane yield (63.7 t/ha) which is statistically at par with the cane yield (63.3 t/ha) recorded by the treatments T_6 ((63.3 t/ha), T_7 (59.7t/ha), T_2 (57.3 t/ha) respectively.

Salient achievements of Crop Production

- During the crop season 2015-16 four trials (experiments) were conducted through length and breadth of the country. These were concentrated on aspects such as agronomic evaluation of promising genotypes for their performance potential under varying fertility levels, efficacy of sub-surface drip method of irrigation in saving of water and raising of crop yield, integrated nutrient management schedule for sugarcane production system to ensure soil health and crop productivity and also to assess the effect of plant growth regulators on germination, growth and cane and sugar productivity.
- Results obtained across the centres revealed that addition of organic manures (FYM or compost) along with bio-fertilizers and recommended nutrients brought about significant enhancement in cane yield over that with application of inorganic fertilizers alone. Better performance under nutrient application based on soil test over that with recommended dose of fertilizers is also evident from the results. Besides inoculation with bio-fertilizers responded better in peninsular zone than others.
- Most of the participating centres have reported the results and other required information like initial soil fertility level, date of planting and harvest and weather conditions as per the suggested format. This need to be regularly followed and may be made more systematic.
- Sub-surface drip irrigation for sugarcane has shown its potential in saving of irrigation water and raising the cane yield. However, observations on root growth pattern, soil wetting zone and root volume need to be included for establishing cause and effect relationship in a scientific manner.
- Use of organics in nutrient management schedule for sugarcane has shown its potential as reflected from the results obtained under the trial AS 68 for plant – ratoon system. 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 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.

3. PLANT PATHOLOGY

In Plant Pathology programme, 21 centres participated in 10 different projects. The summary of achievements of the projects is given below

PP 14: Identification of pathotypes in red rot pathogen

Twelve centres gathered information on new isolates showing pathogenic variability from the previously reported pathotypes. A total of 88 new isolates along with designated pathotypes were tested on host differentials, and among the 12 centres only 5 centres, *i.e.*, Karnal, Anakapalle, Navsari, Coimbatore and Thiruvalla used 19 differentials (including new differentials), while all other centres used 14 differentials to assess pathogen variation. More number of variants have been isolated from the popular varieties such as Co 89003, CoJ 64, CoLk 8102, CoS 8436, CoSe 92423, CoSe 95422, CoC 24 and CoV 09356. In North West zone, Shahjahanpur centre reported possible emergence of 2 new pathotypes *i.e.* R 1102 and R 1304 in Uttar Pradesh. The results of North Central and East Coast zone indicated that there was no emergence of new pathotypes as the new pathotypes behaved more or less similar to the designated pathotypes. In Peninsular zone, the study at Coimbatore indicated the occurrence of new pathotype CF12 in CoV 09356, Co 91017 and Co 94012 and the same has been confirmed by the host differential experiments conducted at Thiruvalla.

PP17: Evaluation of zonal varieties for red rot, smut and wilt

In evaluation of ZVT entries a total of 15 centres carried out testing for red rot, 14 for smut and 5 screened the clones for wilt resistance and identified many numbers of entries as R/MR to red rot, smut and wilt from all the four zones. Many centres also recorded YLD resistance in the ZVT entries. The reaction of entries to red rot, smut and wilt in each zone is presented in the combined Table 1 to 5.

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

Nineteen centres collected the information on diseases naturally occurring in their respective areas. In Uttar Pradesh, incidence of red rot was noticed at 2-5% in CoLk 8102, CoS 8436, CoS 91269, Co 1148, CoJ 85, CoJ 88 and at 30% on UP 9530. The incidence of smut was observed in CoSe 92423, Co 0238, Co 05011, UP 05125 and UP 9530 at various part of western Uttar Pradesh. The incidence of wilt was up to 25% observed on varieties Co 0238, Co 05011 and Co 118 and GSD was reported in almost all the popular sugarcane cultivars and its incidence varied from 1-30 per cent. The incidence of the minor diseases like pokkah boeng was increasing substantially and it was mostly affecting the early sugarcane variety Co 0238. In Bihar, red rot was recorded in BO 130 and CoSe 95422 to the tune of 2-4%. Smut was observed on varieties BO 141, BO 136 and BO 154 and varieties Co 0233, Co 0118 and CoLk 94184 were found affected with wilt. Whereas, Pokkah boeng was observed in Co 0238 and YLD was noticed in the varieties CoLk 94184 and Co 0238. In Uttarakhand, CoS 767 and CoS 8436 were found severely infected by red rot, low incidence of smut was observed in CoPant 05224 and CoS 767 and Co 0238 were found infected with wilt.

GSD was prevalent on many varieties. The YLD was noticed in scant and pokkah boeng incidence was mild to severe in most of the varieties. In Assam, no major or minor disease was found except leaf spots, caused by *Leptosphaeria sacchari.*

In Punjab, red rot was observed up to 5 per cent on varieties CoS 8436, CoJ 64, CoJ 85 and Co 89003. Wilt incidence of 7-8 per cent was observed on Co 89003 and CoS 8436, pokkah boeng disease was observed on variety Co 0238 (1-2%), GSD was observed with an incidence of 1-2% on Co 0238. In Haryana red rot was observed on plant and ratoon crops of CoS 8436, CoJ 85, CoPant 84212 and Co 89003 ranging from 2 to 30 per cent. The incidence of red rot in association with wilt and also combination of red rot and root borer was also observed. Severe wilt incidence was recorded in the variety Co 89003 at many fields of Karnal. Smut incidence ranging from 2- 25 per cent was observed on varieties CoH 150, Co 0238, Co 89003, CoH167 and CoH 99. Pokkah boeng and trace incidence of YLD and mosaic was noticed in many varieties.

In Gujarat, the survey indicated that wilt, red rot and smut were the major diseases in region. The red rot was recorded in the varieties of CoC 671, Co 86032, Co 86002, and Co 97009 to the tune of 3.7 %. The incidence of smut was recorded on CoSi 95071, Co 86002, Co 97009 and Co 99004 to the tune of 15.4 %. The wilt incidence noticed in CoC 671, Co 86032, Co 86002 and CoSi 95071 to the tune of 4.45 % and pokkah boeng was observed in Co 99004.

In Maharashtra, smut was observed in Co 7527 ratoon crop up to 10%. The brown rust is very common on majority of sugarcane varieties commercially grown in the state *viz.*, Co 86032, CoM 0265, CoC 671, CoVSI 9805, VSI 434 and Co 92005 and the intensity was 25-60 %. Similarly, pokkah boeng disease was almost noticed on all sugarcane varieties. YLD was observed in Co 86032 and GSD was recorded in CoM 265. The incidence of ring spot disease was noticed up to 5-15% on the sugarcane variety Co 92005 and in traces on Co 7527. In Karnataka, mild incidence of smut was recorded in most of the varieties, pokkah boeng was observed in few pockets and YLD was observed in some varieties in severe form.

In Andhra Pradesh, red rot incidence (10-40%) was observed on Co 62175, 81 A 99, 93 V 297 and 81 V 48. Smut incidence was noticed in almost all sugarcane growing areas of Andhra Pradesh ranging from 10-35 % mostly on ratoon crop of CoA 92081, CoV 09356 (2003V46), 91 V 83. Wilt incidence was also observed 10-30 % in coastal areas of Andhra Pradesh on Co 8368, 87 A 380, Co 7219, 91 V 83, CoA 92081, Co 62175 and 81 A99. YLD incidences of 10- 70 % were recorded in East Godavari and Visakhapatnam districts. Rust, ring spot and GSD were also predominant on sugarcane. In Tamil Nadu, red rot incidence was recorded in varieties *viz.*, CoC 24, CoSi 7, CoA 92081, CoSi 8, and CoV 09356, Co 0323, PI 1110 and Co 86032 in different districts. Severe smut was noticed on CoA 92081, Co 97009, PI 96-843 and CoC 22, CoSi 8 and Co 86032 and wilt was observed in CoC 22, TNAU Si8 and CoSi 6. Pokkah boeng was also observed in many varieties other than Co 86032. Severe YLD along with degeneration was observed in Co 86032, CoC 24, CoV 94102 and CoV 92102 and healthy seed nursery programme through tissue culture raised seedlings

is gaining momentum in different factory areas to manage YLD and improve cane productivity.

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

Four centres gathered information on elite genotypes that are resistant to red rot. Among 33 ISH genotypes screened at Kapurthala centre none behaved as R, 17 were found MR against CF08 and 22 against CF09. Nine clones were evaluated at Uchani and among them IA 31-32, F1108, IA 30-17, and IA 31-35 were found R/MR. Twenty elite and ISH genotypes were evaluated at Navsari and identified that 13 genotypes, viz.,ISH 111, ISH 58, ISH 100, ISH 287, ISH 12, ISH 50, ISH 147, ISH 267, ISH 229, ISH 118, ISH 117, ISH 114 and ISH 115were MR.

PP 28: B. Methodology for screening sugarcane genotypes for resistance to brown rust

Four centres reported the results of standardizing methodology for inoculation of uredinospores of brown rust and rating of resistance and the results from all centres revealed that leaf whorl inoculation was ideal for disease development.

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

Studies were undertaken in nine centres to assess the development of pokkah boeng disease in relation to weather parameters and its management in sugarcane crop. The results showed that the disease incidence was positively correlated with the number of rainy days, low temperature and high RH. The results of field trials on management of diseases showed that foliar spray of Carbendazim was effective in controlling the disease. Few centres also identified many genotypes that are R/MR to pokkah boeng.

PP 32: Management of brown spot disease of sugarcane

Studies were undertaken in 4 centres to find out effective management of brown spot through chemicals. The five fungicides *viz.*, propiconozole, hexaconozole, tridemefon, mancozeb and carbendazim were tested for the management of disease. Propiconozole (0.1%) was found superior compared to other fungicides for the control of the disease besides, improving cane yield at Sankeshwar centre.

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

S. No.	Genotype	Red rot												Smut		Wilt	
		Kapurthala				Lucknow				Uchani				Kapur-thala	Luck-now	Kapur-thala	Luck-now
		Plug Method		Cotton swab		Plug Method		Cotton Swab		Plug Method		Cotton swab					
		CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09				
IVT Early																	
1	Co 12026	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	-	R	S
2	Co 12027	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MS	-	R	-
3	CoH 12261	MS	MS	R	R	MR	MR	R	R	MR	R	R	R	S	-	R	-
4	CoLk 12201	HS	HS	S	S	MR	MR	R	R	S	S	S	S	MR	-	R	-
5	CoLk 12202	MS	MR	R	R	MR	MS	R	MS	MS	MR	R	R	MS	-	R	-
6	CoLk 12203	HS	S	S	R	MR	MR	R	R	MR	MR	R	R	MS	-	MS	-
7	CoLk 12204	S	S	R	R	MR	MR	R	R	S	MS	R	R	MS	-	MS	-
8	CoPant 12221	MR	MR	R	R	MR	HS	R	S	MR	R	R	R	MR	-	R	S
9	CoPant 12222	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	-	R	-
10	CoS 12231	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MS	-	R	S
11	CoJ 64	HS	HS	S	S	-	-	-	-	HS	S	S	S	S	-	-	-
12	Co 0238	MR	MR	R	R	-	-	-	-	MR	MR	R	R	S	-	-	-
IVT Midlate																	
1	Co 12028	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	-	R	S
2	Co 12029	MR	MR	R	R	MR	MR	R	R	MR	R	R	R	MS	-	R	-
3	CoH 12262	MS	MR	R	R	MR	HS	R	S	R	R	R	R	MS	-	R	S
4	CoH 12263	MR	MR	R	R	MR	HS	MR	S	R	R	R	R	MR	-	R	S
5	CoLk 12205	MR	MR	R	R	MR	MS	R	MR	MS	MR	R	R	MS	-	R	-
6	CoLk 12206	MR	MR	R	R	MR	MS	R	MS	MR	MR	R	R	MS	-	MR	-

S. No.	Genotype	Red rot												Smut		Wilt	
		Kapurthala				Lucknow				Uchani				Kapur-thala	Luck-now	Kapur-thala	Luck-now
		Plug Method		Cotton swab		Plug Method		Cotton Swab		Plug Method		Cotton swab					
		CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09				
7	CoPant 12223	MR	MR	R	R	MR	HS	R	S	MR	R	R	R	MR	-	R	S
8	CoPant 12224	MR	MR	R	R	MR	MS	R	MR	MR	R	R	R	MS	-	R	-
9	CoPant 12225	MR	MR	R	R	MR	S	R	MS	MR	MR	R	R	MR	-	R	S
10	CoPant 12226	HS	HS	S	S	MR	MR	R	R	S	MS	R	R	MR	-	MR	S
11	CoPb 12181	S	MS	R	R	MR	MR	MR	R	MS	R	R	R	MR	-	R	-
12	CoPb 12182	MS	MS	R	R	MR	S	R	MS	MS	MR	R	R	MS	-	MR	-
13	CoPb 12211	MR	MR	R	R	MR	MS	R	MR	MR	R	R	R	MR	-	R	-
14	CoPb 12212	MR	MR	R	R	MR	MR	R	R	MR	R	R	R	MS	-	R	S
15	CoS 12232	MR	MR	R	R	S	HS	MS	S	MR	MR	R	R	MS	-	R	S
16	CoS 767	S	HS	S	S	MR	S	R	S	MS	S	R	R	S	-	-	-
17	CoS 8436	MR	MR	R	R	-	-	-	-	MR	MR	R	R	MS	-	-	-
18	CoPant 97222	MR	MS	R	R	-	-	-	-	S	MS	S	S	MS	-	-	-
AVT (Early) Plant I																	
1	CoH 11262	MR	MR	R	R	HS	HS	S	S	R	R	R	R	MR	S	MS	-
2	CoLk 11201	MS	MR	R	R	MR	MS	R	MR	MS	MR	R	R	MS	-	R	-
3	CoLk 11202	MR	MR	R	R	MR	MS	R	MR	MR	R	R	R	MS	-	R	-
4	CoLk 11203	MS	MR	R	R	MR	MR	R	MR	MR	MR	R	R	MS	S	MR	-
5	CoJ 64	HS	HS	S	S	H	S	S	S	HS	S	S	S	S	-	-	-
6	Co 0238	MR	MR	R	R	-	-	-	-	MR	MR	R	R	-	-	-	-
7	Co Pant 84211	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-

S. No.	Genotype	Red rot												Smut		Wilt	
		Kapurthala				Lucknow				Uchani				Kapur-thala	Luck-now	Kapur-thala	Luck-now
		Plug Method		Cotton swab		Plug Method		Cotton Swab		Plug Method		Cotton swab					
		CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09				
AVT (Early) Plant II																	
1	Co 10035	MR	MR	R	R	MR	MR	R	MR	MR	MR	R	R	MR	-	MR	-
2	CoH 10261	MS	MR	R	R	MR	MR	R	R	R	R	R	R	MR	-	R	-
3	CoS 10231	MR	MS	R	R	MR	MR	R	R	MR	MR	R	R	MS	S	R	S
4	CoJ 64	HS	HS	S	S	-	-	-	-	S	S	S	S	S	-	-	-
5	Co 0238	MR	MR	R	R	-	-	-	-	-	-	-	-	-	-	-	-
6	Co Pant 84211	-	-	-	-	-	-	-	-	S	S	S	S	S	-	-	-
AVT (Midlate) Plant I																	
1	Co 11027	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MS	S	R	S
2	CoH 11263	MR	MR	R	R	MR	MR	R	R	R	R	R	R	MR	S	MR	-
3	CoLk 11204	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MS	S	R	-
4	CoLk 11206	MR	MR	R	R	MR	MS	R	MR	MR	MR	R	R	MS	S	R	-
5	CoPb 11214	MS	MR	R	R	MR	MR	R	R	MR	MS	R	R	MR	S	R	-
6	CoS 11232	MR	MR	R	R	MS	S	MS	S	MR	MR	R	R	MS	-	MR	-
7	CoS 767	S	HS	S	S	MR	S	R	S	MS	S	S	S	S	-	-	-
8	CoS 8436	MR	MR	R	R	-	-	-	-	MR	MR	R	R	MS	-	-	-
9	CoPant 97222	MS	MS	S	S	-	-	-	-	S	MS	S	S	MS	-	-	-

S. No.	Genotype	Red rot												Smut		Wilt	
		Kapurthala				Lucknow				Uchani				Kapur-thala	Luck-now	Kapur-thala	Luck-now
		Plug Method		Cotton swab		Plug Method		Cotton Swab		Plug Method		Cotton swab					
		CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09	CF 08	CF 09				
AVT Midlate Plant II																	
1	Co 10036	MS	MR	R	R	MR	MR	R	R	MS	MR	R	R	MR	S	R	-
2	CoH 10262	MR	MR	R	R	MR	MR	R	R	MR	R	R	R	MR	S	R	S
3	CoPant 10221	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	S	R	S
4	CoPb 10181	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	-	R	S
5	CoPb 10182	MR	MR	R	R	MR	MR	R	R	MS	MR	R	R	MS	-	R	-
6	CoS 767	S	HS	S	S	MR	S	-	-	S	MS	S	S	S	-	-	-
7	CoS 8436	MR	MR	R	R	-	-	-	-	MR	MR	R	R	MS	-	-	-
8	CoPant 97222	MS	MS	S	S	-	-	-	-	S	MS	S	S	MS	-	-	-
9	Co 7717	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-
10	Co 89003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-
Check	Co 1158	-	-	-	-	-	-	-	-	-	-	-	-	HS	S	-	-
Check	CoLk 7701	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-
Smut-Standards																	
1	Co 740	-	-	-		-		-	-	-	-	-	-	HS	-	-	-
2	Co 7915	-	-	-	-	-	-	-	-	-	-	-	-	MR	-	-	-
3	Co 62175	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-
4	Co 310	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-
5	Katha	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-

Table 2. Reaction of ZVT entries for red rot and smut (North West Zone II)

S. No.	Genotypes	Shahjahanpur					Pantnagar					Karnal			
		Plug		Cotton Swab		Smut	Plug		Cotton swab		Smut	Plug		Cotton swab	
		CF 08	CF 09	CF 08	CF 09		CF 08	CF 09	CF 08	CF 09		CF 08	CF 09	CF 08	CF 09
IVT Early															
1	Co 12026	S	HS	MS	S	R	MR	MR	R	R	MS	MR	MR	R	R
2	Co 12027	HS	HS	S	S	R	MR	MR	R	R	MS	MS	MS	R	R
3	CoH 12261	HS	HS	S	S	R	MS	MS	R	R	MS	MS	MS	R	R
4	CoLk 12201	HS	HS	S	S	R	MS	MS	R	R	R	S	S	S	S
5	CoLk 12202	S	S	MS	MS	R	S	S	S	S	MR	MS	R	R	R
6	CoLk 12203	MR	MR	R	R	R	MS	MS	R	R	HS	MR	R	R	R
7	CoLk 12204	MS	MS	MR	MR	R	R	R	R	R	R	S	S	R	R
8	CoPant 12221	MR	MR	R	R	R	R	R	R	R	MR	R	MR	R	R
9	CoPant 12222	MS	MS	MR	MR	R	MS	MS	S	S	R	MR	MR	R	R
10	CoS 12231	MR	MR	R	R	R	MR	MR	R	R	MS	MR	R	R	R
11	CoJ 64	HS	HS	S	S	R	S	S	S	S	-	MS	S	S	S
12	Co 0238	MS	S	MR	MS	R	-	-	-	-	-	R	R	R	R
13	Co 1158	-	-	-	-	HS	-	-	-	-	-	-	-	-	-
IVT Midlate															
1	Co 12028	MS	MR	MR	R	R	R	R	R	R	S	MR	R	R	R
2	Co 12029	HS	HS	S	S	R	R	R	R	R	MR	MR	R	R	R
3	CoH 12262	S	S	MS	MS	R	MR	MR	R	R	R	MR	R	R	R

S. No.	Genotypes	Shahjahanpur					Pantnagar					Karnal			
		Plug		Cotton Swab		Smut	Plug		Cotton swab		Smut	Plug		Cotton swab	
		CF 08	CF 09	CF 08	CF 09		CF 08	CF 09	CF 08	CF 09		CF 08	CF 09	CF 08	CF 09
4	CoH 12263	S	MS	MS	MR	R	R	R	R	R	MR	R	MR	R	R
5	CoLk 12205	MS	MS	MR	MR	R	R	R	R	R	S	MS	MR	R	R
6	CoLk 12206	S	S	MS	MS	R	R	R	R	R	MS	MR	R	R	R
7	CoPant 12223	MR	MR	R	R	R	MS	MS	S	S	MS	MR	R	R	R
8	CoPant 12224	MS	MR	MR	R	R	MR	MR	R	R	MS	MR	R	R	R
9	CoPant 12225	MR	MS	R	MR	R	R	R	R	R	MS	R	R	R	R
10	CoPant 12226	MS	MR	MR	R	R	MR	MR	R	R	R	MS	MS	R	R
11	CoPb 12181	S	S	MS	MS	R	MS	MS	R	R	S	MR	R	R	R
12	CoPb 12182	HS	HS	S	S	R	MR	MR	R	R	MR	MR	MR	R	R
13	CoPb 12211	S	MS	MS	MR	R	MR	MR	R	R	MR	MR	MR	R	R
14	CoPb 12212	MS	MS	MR	MR	R	MR	MR	R	R	MR	MR	MR	R	R
15	CoS 12232	MR	MR	R	R	R	MR	MR	R	R	S	MR	R	R	R
16	CoS 767	MS	HS	MR	S	R	HS	HS	S	S	-	MS	MS	S	R
17	CoPant 97222	S	MS	MS	S	R	MR	MR	R	R	-	S	MR	R	R
18	Co 1158	-	-	-	-	S	-	-	-	-	-	-	-	-	-
AVT (Early) Plant-I															
1	CoLk 11201	MS	MS	MR	MR	R	S	S	S	S	R	S	MR	S	R
2	CoLk 11202	MR	MR	R	R	R	MR	MR	R	R	R	MR	R	R	R
3	CoLk 11203	MS	MS	MR	R	MR	R	R	R	R	S	MS	MR	R	R
4	CoH 11262	HS	HS	S	S	R	HS	HS	S	S	R	S	MS	S	S
5	Co 1158	-	-	-	-	HS	-	-	-	-	-	-	-	-	-

S. No.	Genotypes	Shahjahanpur					Pantnagar					Karnal			
		Plug		Cotton Swab		Smut	Plug		Cotton swab		Smut	Plug		Cotton swab	
		CF 08	CF 09	CF 08	CF 09		CF 08	CF 09	CF 08	CF 09		CF 08	CF 09	CF 08	CF 09
AVT (Early) Plant-II															
1	Co 10035	MS	MS	MR	MR	MR	R	R	R	R	S	R	R	R	R
2	CoS 10231	MR	MR	R	R	R	MR	MR	R	R	MS	MR	MR	R	R
3	CoH 10261	MS	MS	MR	MR	R	R	R	R	R	R	S	MR	S	R
4	Co 0238	MS	S	MR	MS	R						R	R	R	R
5	CoJ 64	HS	HS	S	S	R	S	S	S	S	MS	MS	S	S	R
6	CoPant 84211	MS	S	R	MS	R	MS	MS	S	S	MS	S	S	S	S
7	Co 1158	-	-	-	-	HS									
AVT Midlate Plant-I															
1	Co 11027	MR	MR	R	R	R	-	-	-	-	-	R	MR	R	R
2	CoH 11263	MR	MR	R	R	R	S	S	S	S	MS	R	R	R	R
3	CoLk 11204	MR	MS	R	MR	R	R	R	R	R	MR	MR	R	R	R
4	CoLk 11206	MR	MR	R	R	R	MS	MS	R	R	MR	R	MR	R	R
5	CoS 11232	MR	MR	R	R	R	R	R	R	R	R	MR	R	R	R
6	Co 1158	-	-	-	-	S	-	-	-	-	-	-	-	-	-
7	CoPb 11214	-	-	-	-	-	R	R	R	R	MS	MR	MR	R	R
AVT Midlate Plant -II															
1	Co 10036	MS	MS	MR	MR	R	MS	MS	R	R	MR	R	R	R	R
2	CoH 10262	MR	MR	R	R	R	R	R	R	R	S	MR	R	R	R
3	CoPant 10221	MR	MR	R	R	MR	R	R	R	R	R	MR	R	R	R
4	CoPb 10181	MR	MR	R	R	R	R	R	R	R	R	R	R	R	R

S. No.	Genotypes	Shahjahanpur					Pantnagar					Karnal			
		Plug		Cotton Swab		Smut	Plug		Cotton swab		Smut	Plug		Cotton swab	
		CF 08	CF 09	CF 08	CF 09		CF 08	CF 09	CF 08	CF 09		CF 08	CF 09	CF 08	CF 09
5	CoPb 10182	HS	HS	S	S	R	MS	MS	R	R	R	MS	MS	R	R
6	CoS 767	MS	S	MR	MR	R	HS	HS	S	S	S	MS	MS	S	R
7	CoS 8436	MS	MS	MR	MR	R	S	S	S	S	MS	MR	MR	R	R
8	CoPant 97222	S	S	MS	MS	R	MR	MR	R	R	R	S	MR	R	R
9	Co 1158	-	-	-	-	S	-	-	-	-	R	-	-	-	-
13	CoJ 64	-	-	-	-	-	S	S	S	S	MS	MS	S	S	R
14	Co 0238	-	-	-	-	-	-	-	-	-	-	R	R	R	R
15	CoPant 84211	-	-	-	-	-	MS	MS	S	S	MS	S	S	S	S
16	Co 1148	-	-	-	-	-	MS	MS	S	S	-	-	-	-	-
17	CoSe 97222	-	-	-	-	-	MR	MR	R	R	-	-	-	-	-
18	Co 1158(Pusa)	-	-	-	-	-	-	-	-	-	R	-	-	-	-
19	Co 1158	-	-	-	-	-	-	-	-	-	R	-	-	-	-

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

S. No.	Genotypes	Red rot																Smut		Wilt
		Motipur				Seorahi				Pusa				Buralikson				Seorahi	Pusa	Pusa
		CF 07		CF 08		CF 07		CF08		Plug method		Cotton swab		CF 07		CF 08				
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	CF07	CF08	CF07	CF08	Plug	Nodal	Plug	Nodal			
IVT (Early) Plant																				
1	CoLk 12207	HS	S	HS	S	MR	R	MR	R	MR	MR	R	R	R	R	MR	R	R	R	R
2	CoLk 12208	MR	R	MR	R	MR	R	MR	R	MR	MR	R	R	MR	R	MR	R	HS	R	R
3	CoP 12436	MR	R	MR	R	MR	R	MR	R	MR	MS	R	R	MR	R	MR	R	S	R	MR
4	CoP 12437	MR	R	MR	R	MR	R	MR	R	MR	MR	R	R	MR	R	MR	R	R	R	MR
5	CoSe 12451					MR	R	MR	R	MR	MR	R	R	MR	R	MR	R	MR	R	MR
IVT (Midlate) Plant																				
1	CoLk 09204	MS	MR	MR	MR	MR	R	MR	R	MR	MR	R	R	MR	R	MR	R	R	R	MR
2	CoLk 12209	MR	R	MR	R	MR	R	MR	R	MR	MS	R	R	MR	R	MR	MR	R	R	R
3	CoP 12438	MR	R	MR	R	MR	R	MR	R	MR	MS	R	R	MS	R	MR	R	R	MR	MR
4	CoP 12439	MR	R	MR	R	MR	R	MR	R	MS	MR	R	R	MR	R	MR	R	R	R	MR
5	CoSe 12452	MR	R	MR	R	MR	R	MR	R	MS	MR	R	R	MR	R	MR	R	R	R	MS
6	CoSe 12453	MR	R	MR	R	MR	R	MR	R	MR	MR	R	R	MR	R	MR	R	R	R	MR

S. No.	Genotypes	Red rot																Smut		Wilt
		Motipur				Seorahi				Pusa				Buralikson				Seorahi	Pusa	Pusa
		CF 07		CF 08		CF 07		CF08		Plug method		Cotton swab		CF 07		CF 08				
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	CF07	CF08	CF07	CF08	Plug	Nodal	Plug	Nodal			
AVT (Early) Plant I																				
1	CoP 11436	MS	MR	S	MS	MR	R	MR	R	-	-	-	-	MR	R	MR	R	HS	-	-
2	CoP 11437	MR	R	MR	R	MR	R	MR	R	-	-	-	-	MR	R	MR	R	MS	-	-
3	CoP 11438	MR	R	MS	MS	MR	R	MR	R	-	-	-	-	MR	R	MR	R	HS	-	-
4	CoSe 11451	MR	R	S	MS	MR	R	MR	R	-	-	-	-	MR	R	MR	R	MS	-	-
AVT (Midlate) Plant I																				
1	BO 155	MR	R	MR	R	MR	R	MR	R	-	-	-	-	MR	R	MR	R	R	-	-
2	CoSe 11453	MR	R	MR	R	MR	R	MR	R	-	-	-	-	R	R	MR	R	R	-	-
3	CoSe 11454	MR	R	MR	R	MR	R	MR	R	-	-	-	-	MR	R	MR	R	R	-	-
4	CoSe 11455	MR	R	MR	R	MR	R	MR	R	-	-	-	-	MR	R	MR	R	R	-	-
5	CoSe 11456	-	-	-	-	MR	R	MR	R	-	-	-		-	-	-	-	R	-	-
6	CoP 11439	-	-	-	-	MR	R	MR	R	-	-		-	-	-	-	-	R	-	-
7	CoP 11440	-	-	-	-	MR	R	MR	R	-	-	-	-	-	-	-	-	R	-	-
AVT (Midlate) Plant II																				
1	CoSe 10451	MR	R	MR	R	MR	R	MR	R	-	-	-	-	MR	R	MR	R	R	-	-
2	CoSe 10452	MR	R	MR	R	MR	R	MR	R	-	-	-	-	MR	R	MR	R	R	-	-

S. No.	Genotypes	Red rot																Smut		Wilt
		Motipur				Seorahi				Pusa				Buralikson				Seorahi	Pusa	Pusa
		CF 07		CF 08		CF 07		CF08		Plug method		Cotton swab		CF 07		CF 08				
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	CF07	CF08	CF07	CF08	Plug	Nodal	Plug	Nodal			
3	CoSe 10453	MR	R	MR	R	MR	R	MR	R	-	-	-	-	MR	R	MR	R	MR		
4	CoP9301	MR	-	MR	-	-	-	-	-	MR	R	R	R	MS	S	S	S		R	MR
5	CoSe 95422	MS	-	S	-	-	-	-	-	S	S	S	S	MS	R	MS	R	-	-	S
6	Co1158	-	-	-	-	HS	-	-	-	-	-	-	-	-	-	-	-	-	HS	-
7	BO 130	-	-	-	-	-	-	-	-	-	-	-	-	MR	R	MR	R	-	R	MR

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

S. No.	Genotypes	Anakapalle									Cuddalore				
		Red rot						Smut	Wilt	YLD	Red rot				Smut
		CF04		CF06		CF05					CF04		CF06		
		Plug	Nodal	Plug	Nodal	Plug	Nodal				Plug	Nodal	Plug	Nodal	
IVT (Early)															
1	CoA 13321	MR	R	MR	R	MR	R	MR	R	MR	R	R	R	R	MS
2	CoA 13322	MR	R	MR	R	MR	R	MR	MR	MS	MR	R	MR	R	MS
3	CoA 13323	HS	R	HS	R	HS	R	MS	HS	MR	MS	R	MR	R	MS
4	CoA 13324	HS	S	HS	S	HS	S	R	MR	S	HS	R	S	S	MS
5	CoC 13336	-	-	-	-	-	-	-	-	-	MS	R	MR	R	MS
6	CoC 13337	-	-	-	-	-	-	-	-	-	MR	R	MR	R	R
7	CoC 13338	-	-	-	-	-	-	-	-	-	HS	S	HS	S	R
8	CoV 13356	MR	R	MR	R	MR	R	R	MS	S	MR	R	MS	R	R
IVT (Early) I Plant															
1	CoA 12321	R	R	R	R	MR	R	HS	MR	R	MS	R	MR	R	S
2	CoA 12322	R	R	R	R	MR	R	HS	MS	R	R	R	MR	R	R
3	CoA 12323	-	-	-	-	-	-	-	-	-	MS	R	S	S	MS
4	CoOr 12346	-	-	-	-	-	-	-	-	-	MR	R	MS	R	MR
5	CoV 12356	-	-	-	-	-	-	-	-	-	MR	R	MR	R	MR
AVT- Early (II Plant)															
1	CoA 11321	R	R	MR	R	MR	R	S	S	S	MR	R	MR	R	MS
2	CoA 11323	HS	S	HS	S	HS	S	S	MR	S	S	S	HS	R	MS

S. No.	Genotypes	Anakapalle									Cuddalore				
		Red rot						Smut	Wilt	YLD	Red rot				Smut
		CF04		CF06		CF05					CF04		CF06		
		Plug	Nodal	Plug	Nodal	Plug	Nodal				Plug	Nodal	Plug	Nodal	
3	CoA 11326	MR	R	R	R	R	R	HS	S	MS					
4	CoC 10336	-	-	-	-	-	-	-	-	-	HS	S	MS	S	MR
5	CoC 11336	-	-	-	-	-	-	-	-	-	MR	R	MR	R	MR
IVT - Mid late															
1	CoA 12324	-	-	-	-	-	-	-	-	-	MS	R	MS	R	R
2	CoA 13325	R	R	R	R	R	R	R	R	MS	R	R	MR	R	R
3	CoA 13326	HS	R	HS	R	HS	R	R	HS	MR	S	R	HS	S	HS
4	CoA 13327	HS	S	HS	S	HS	S	MR	MS	MS	MS	R	MR	R	R
5	CoA 13328	MR	R	MR	R	MR	R	R	MR	MS	MS	R	MR	R	HS
6	CoC 13339	-	-	-	-	-	-	-	-	-	MR	R	MR	R	R
7	CoOr 13346	-	-	-	-	-	-	-	-	-	MR	R	MR	R	R
8	CoV 12357	-	-	-	-	-	-	-	-	-	HS	R	MS	R	R
9	CoA 92081	R	R	R	R	R	R	HS	MS	S	-	-	-	-	-
10	Co 29094	MS	R	MR	R	MS	R	R	MR	MS	-	-	-	-	-
11	87A298	-	-	-	-	-	-	-	MS	S	-	-	-	-	-
12	CoA 12322	R		R		MR			MS	R	-	-	-	-	-
13	2011 A 78	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
14	2011A 11	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
15	2011 A 319	-	-	-	-	-	-	-	-	S	-	-	-	-	-
16	2011 A 67	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
17	2011 A 252	-	-	-	-	-	-	-	-	MS	-	-	-	-	-

S. No.	Genotypes	Anakapalle									Cuddalore				
		Red rot						Smut	Wilt	YLD	Red rot				Smut
		CF04		CF06		CF05					CF04		CF06		
		Plug	Nodal	Plug	Nodal	Plug	Nodal				Plug	Nodal	Plug	Nodal	
18	2011 A 313	-	-	-	-	-	-	-	-	MR	-	-	-	-	-
19	2011 A 259	-	-	-	-	-	-	-	-	MR	-	-	-	-	-
20	2011 A 67	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
21	2011 A 262	-	-	-	-	-	-	-	-	MR	-	-	-	-	-
22	2011 A 260	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
23	2011 A 294	-	-	-	-	-	-	-	-	MR	-	-	-	-	-
24	2011 A 113	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
25	2012 A 287	-	-	-	-	-	-	-	-	HS	-	-	-	-	-
26	2012 A 246	-	-	-	-	-	-	-	-	S	-	-	-	-	-
27	2012 A 279	-	-	-	-	-	-	-	-	HS	-	-	-	-	-
28	2012 A 335	-	-	-	-	-	-	-	-	HS	-	-	-	-	-
29	2012 A 149	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
30	2012 A 23	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
31	2012 A 340	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
32	2012 A 145	-	-	-	-	-	-	-	-	MR	-	-	-	-	-
33	2012 A 264	-	-	-	-	-	-	-	-	MR	-	-	-	-	-
34	2012 A 249	-	-	-	-	-	-	-	-	HS	-	-	-	-	-
35	2012 A 319	-	-	-	-	-	-	-	-	HS	-	-	-	-	-
36	2012 A 277	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
37	2011 A 255	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
38	87 A 298	-	-	-	-	-	-	-	-	S	-	-	-	-	-
39	2011 A 175	-	-	-	-	-	-	-	-	MS	-	-	-	-	-
40	Co 97009	-	-	-	-	-	-	-	-	-	-	-	-	-	HS
41	CoC 22	-	-	-	-	-	-	-	-	-	-	-	-	-	S

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

S. No.	Genotypes	Red rot								Smut							Wilt
		Coimbatore		Thiruvalla				Navsari		Coimbatore	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Navsari
				CF06		CF12											
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal								
IVT (Early)																	
1	Co 11001	-	-	-	-	-	-	-	-	-	-	-	MS	MR	-	-	-
2	Co 11004	-	-	-	-	-	-	-	-	-	-	-	MS	R	-	-	-
3	Co 11016	-	-	-	-	-	-	-	-	-	-	-	S	R	-	R	-
4	Co 11017	-	-	-	-	-	-	-	-	-	-	-	R	R	-	-	-
5	Co 11018	-	-	-	-	-	-	-	-	-	-	-	R	R	-	-	-
6	CoM 11081	-	-	-	-	-	-	-	-	-	-	-	HS	R	-	-	-
7	CoM 11082	-	-	-	-	-	-	-	-	-	-	-	MS	MS	-	-	-
8	CoM 11083	-	-	-	-	-	-	-	-	-	-	-	HS	S	-	-	-
9	CoM 11084	-	-	-	-	-	-	-	-	-	-	-	MS	MR	-	-	-
10	CoN 11071	-	-	-	-	-	-	-	-	-	-	-	R	MR	MR	-	-
11	CoN 11072	-	-	-	-	-	-	-	-	-	-	-	R	MR	R	-	-
12	CoT 11366	-	-	-	-	-	-	-	-	-	-	-	R	R		-	-
13	PI 11131	-	-	-	-	-	-	-	-	-	-	-	MS	R		-	-
14	Co 12001	MR	R	MR	R	MR	R	S	R	MS	R	R	-	-	R	MR	-
15	Co 12003	MR	R	MR	R	MR	R	S	R	MR	R	R	-	-	R	R	-
16	Co 12006	MR	R	MR	R	MR	R	MR	R	MS	MR	MR	-	-	HS	R	-
17	Co 12007	MS	R	MS	R	MS	R	S	R	HS	R	R	-	-	S	R	-

S. No.	Genotypes	Red rot								Smut							Wilt
		Coimbatore		Thiruvalla				Navsari		Coimbatore	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Navsari
				CF06		CF12											
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal								
18	Co 12008	R	R	MR	R	MR	R	S	R	HS	MS	MS	-	-	R	MS	-
19	CoM 12081	S	R	MS	R	MR	R	MR	R	HS	R	R	-	-		R	-
20	CoM 12082	R	R	MR	R	MR	R	MR	R	HS	R	R	-	-	S	MR	-
21	CoM 12083	S	S	MS	R	MS	R	HS	R	MR	R	R	-	-		R	-
22	CoN 12071	MR	-	MS	R	MS	R	MS	R	HS	R	R	-	-		R	-
23	CoN12072	R	R	MR	R	MR	R	MR	R	HS	R	R	-	-	-	R	-
24	CoN12073	-	-	-	-	-	-	-	-	-			-	-	-	-	-
25	CoN12074	-	-	-	-	-	-	-	-	-	MR	HS	-	-	-	-	-
26	CoT 12368	-	-	-	-	-	-	-	-	-	MR	MS	-	-	-	-	-
27	VSI 12121	-	-	-	-	-	-	-	-	-	MR	HS	-	-	-	-	-
28	CoT 12366	MR	R	MR	R	MR	R	HS	R	MS	R	R	-	-	-	R	-
29	CoT 12367	MR	R	MR	R	MR	R	S	R	MS	R	R	-	-	-	R	-
30	Co 85004	-	-	S	R	MS	R	MS	R	-	MR	MR	-	-	R	R	-
31	Co 94008	-	-	MS	R	MS	R	MR	R	-	R	R	-	-	R	R	-
32	CoC 671	HS	S	HS	S	S	S	HS	S	-	R	R	-	-	MS	MR	-
33	Co 7219	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-
34	Co 99004	-	-	-	-	-	-	-	-	-	R	-	-	-	-	MS	MR
35	Co 86032	-	-	-	-	-	-	-	-	-	R	-	-	-	-	MS	MS

S. No.	Genotypes	Red rot								Smut							Wilt
		Coimbatore		Thiruvalla				Navsari		Coimbatore	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Navsari
				CF06		CF12											
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal								
IVT (Midlate) Plant																	
1	Co 12009	MS	R	MR	R	MR	R	MR	R	HS	MS	MS	-	-	R	MS	-
2	Co 12012	MS	R	MR	R	MR	R	HS	R	HS	MR	MR	-	-	MS	R	-
3	Co 12014	R	R	MR	R	R	R	MR	R	MS	R	R	-	-	MR	R	-
4	Co 12016	MR	R	MR	R	MR	R	MR	R	S	R	R	-	-	R	R	-
5	Co 12017	S	S	MR	R	MR	R	HS	R	MR	R	R	-	-	R	R	-
6	Co 12019	R	R	MR	R	MR	R	MR	R	HS	R	R	-	-	R	R	-
7	Co 12021	MS	R	MS	R	MS	R	-	-	MR	R	R	-	-	R	R	-
8	Co 12024	-	R	MS	R	MS	R	MS	R	HS	MR	MR	-	-	HS	R	-
9	CoM 12084	S	R	MS	R	MS	R	HS	R	S	R	R	-	-	R	R	-
10	CoM 12085	HS	S	MS	R	MS	R	HS	S	HS	R	R	-	-	R	R	-
11	CoM 12086	MS	R	MR	R	MR	R	MS	R	HS	R	R	-	-	S	MS	-
12	CoN 12073	MR	R	MR	R	MR	R	MR	R	MS	R	R	-	-	MR	R	-
13	CoN 12074	HS	S	S	R	S	R	MS	R	HS	MR	MR	-	-	S	R	-
14	CoT 12368	HS	S	MS	R	MS	R	HS	R	HS	MR	MR	-	-	R	R	-
15	VSI 12121	S	S	MS	R	MR	R	MR	R	HS	R	R	-	-	S	R	-
AVT (Early I) Plant																	
1	Co10004	-	-	MR	R	MR	R	S	R	-	R	R	-	MR	R	MR	S
2	Co10006	-	-	MR	R	MR	R	MR	R	-	R	R	-	MS	MS	R	MR

S. No.	Genotypes	Red rot								Smut							Wilt
		Coimbatore		Thiruvalla				Navsari		Coimbatore	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Navsari
				CF06		CF12											
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal								
3	Co 10005	-	-	MR	R	MR	R	MR	R	-	R	R	-	MS	R	R	MR
4	Co 10024	-	-	MS	R	MR	R	MS	R	-	R	R	-	MR	MR	S	MR
5	Co 10026	-	-	MR	R	MR	R	MR	R	-	R	R	-	MR	R	HS	MR
6	Co10027	-	-	MR	R	MR	R	MR	R	-	MR	MR	-	MR	R	MS	MR
7	CoT 10367	-	-	MR	R	MR	R	MR	R	-	R	R	-	MR	MS	MR	MR
8	CoT10366	-	-	MS	R	MS	R	MS	R	-	R	R	-	R	MS	R	MR
9	CoC 671	-	-	HS	S	S	S	HS	S	-	-	-	-	-	S	MR	S
10	Co94008	-	-	MS	R	MS	R	MR	R	-	-	-	-	-	R	R	MR
11	Co85004	-	-	S	R	MS	R	MS	R	-	-	-	-	-	R	-	MS
AVT Early II Plant																	
1	Co 09004	-	-	R	R	R	R	MR	R	-	R	R	S	MS	R	R	MR
2	Co 09007	-	-	MS	MS	MS	R	S	R	-	R	R	S	MR	R	MR	MR
3	CoN 09072	-	-	MS	MR	MR	R	MR	R	-	MR	MS	R	MR	MR	R	MR
4	CoC671	-	-	HS	S	S	S	-	-	-	R	R	-	-	S	-	-
5	Co94008	-	-	MS	R	MS	R	-	-	-	R	R	-	-	R	-	-
6	Co85004	-	-	S	R	MS	R	-	-	-	MR	MR	-	-	MR	-	-
7	Snk 07680	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	-	-
8	Co 8011	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-
9	Co 740	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-

S. No.	Genotypes	Red rot								Smut							Wilt
		Coimbatore		Thiruvalla				Navsari		Coimbatore	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Navsari
				CF06		CF12											
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal								
AVT Midlate (I Plant)																	
1	Co 09009	-	-	MR	R	MR	R	MR	R	-	R	R	-	MR	R	MR	S
2	Co10015	-	-	MS	R	MR	R	MR	R	-	S	S	-	S	R	S	MR
3	Co10017	-	-	MS	R	MS	R	HS	S	-	MR	MS	-	MS	HS		S
4	Co 10031	-	-	MR	R	MR	R	MR	R	-	MR	MR	-	MR	MS	MS	MR
5	Co 10033	-	-	MR	R	MR	R	S	R	-	MR	MR	-	MS	R	HS	S
6	CoM10083	-	-	MS	R	MR	R	M	R	-	R	R	-	MR	R	MR	S
7	CoT 10368	-	-	MR	R	MR	R	MR	R	-	R	R	-	R	R	R	MR
8	CoT 10369	-	-	MR	R	MR	R	MR	R	-	R	R	-	R	R	R	S
9	CoVc 10061	-	-	MR	R	MR	S	MR	R	-	MR	MR	-	R	MR	R	S
10	PI 10131	-	-	MR	R	MR	R	MR	R	-	MS	S	-	MR	R	MR	MS
11	PI 10132	-	-	MR	R	MR	R	MS	R	-	MR	MS	-	MR	R	R	MR
12	Co99004	-	-	HS	R	MS	R	-	-	-	R	R	-	-	MS	-	-
13	Co86032	-	-	MS	R	MS	R	-	-	-	R	R	-	-	R	-	-
14	Co 8011	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	-
15	Co 740	-	-	-	-	-	-	-	-	-	S	S	-	-	S	-	-
IVT (Midlate) Plant																	
1	Co11021	-	-	-	-	-	-	-	-	-	-	-	R	R	-	-	-
2	Co11022	-	-	-	-	-	-	-	-	-	-	-	R	MR	-	-	-

S. No.	Genotypes	Red rot								Smut							Wilt
		Coimbatore		Thiruvalla				Navsari		Coimbatore	Kolhapur	Padegaon	Pune	Powerkheda	Sankeswar	Navsari	Navsari
				CF06		CF12											
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal								
3	Co11023	-	-	-	-	-	-	-	-	-	-	-	R	R	-	-	-
4	Co11024	-	-	-	-	-	-	-	-	-	-	-	R	MR	-	-	-
5	CoM11085	MR	R	-	-	-	-	-	-	-	-	-	R	MR	-	-	-
6	CoM11086	-	-	-	-	-	-	-	-	-	-	-	R	MR	-	-	-
7	CoM11087	MR	R	-	-	-	-	-	-	-	-	-	R	MS	-	-	-
8	CoN11073	-	-	-	-	-	-	-	-	-	-	-	R	MR	-	-	-
9	CoN11074	-	-	-	-	-	-	-	-	-	-	-	R	MR	-	-	-
10	Co11005	-	-	-	-	-	-	-	-	-	-	-	MS	R	-	-	-
11	Co11007	-	-	-	-	-	-	-	-	-	-	-	MS	R	-	-	-
12	Co11012	-	-	-	-	-	-	-	-	-	-	-	MS	R	-	-	-
13	Co11019	R	R	-	-	-	-	-	-	-	-	-	MS	MR	-	-	-
14	Co11020	S	S	-	-	-	-	-	-	-	-	-	MS	R	-	-	-

Salient achievements of Plant Pathology

- About 10 projects were operated under Plant Pathology discipline and21 centers from the five zones participated in the programme.
- Break down of the popular varieties Co 89003, CoLk 8102, CoS 8436, CoSe 92423 and CoSe 95422 to red rot in the subtropical region is witnessed. Similarly occurrence of red rot in the popular varieties CoV 09356 and CoC 24 is also a serious concern. There is possibility of emergence of new pathotypes from them.
- Differential host studies to identify variation in red rot were conducted at 12 centres in four zones with 88 new isolates along with designated pathotypes. More number of variants have been isolated from the popular varieties such as Co 89003, CoJ 64, CoLk 8102, CoS 8436, CoSe 92423, CoSe 95422, CoC 24 and CoV 09356.
- 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 89003 and CoS 8436 in North West zone. In the tropical India, there is a clear evidence for the domination of the pathotype CF12 among the new isolates.
- About 15 centres have carried out red rot testing, 14 for smut and 5 have screened the clones for wilt resistance. Large numbers of entries were identified as R/MR to red rot, smut and wilt from all the four zones.
- Cotton swab nodal method has been found consistent 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 is a growing importance of smut in subtropical region. In tropical India, the severity of smut has come down in Maharashtra and Karnataka, however it increased in parts of Andhra Pradesh, Telangana and Gujarat.
- Occurrence of YLD, wilt, rust, *pokkah boeng* and brown spot to varying proportions were recorded in different states. YLD occurrence is reported from all the states especially it occurs in epidemic proportions in all the states of tropical region. Occurrence of GSD has been reported in most of the regions, however its severity was found to be more in Uttar Pradesh.
- Clean seed programme initiated after virus elimination through tissue culture combined with molecular diagnosis was found to be effective to rejuvenate degenerated sugarcane varieties. Sugarcane crop raised through clean seed nurseries recorded more than 25 tonnes cane yield per hectare.
- Three years of work on rust inoculation methods revealed that leaf whorl inoculation is ideal for disease development. Useful information has been generated on *pokkah boeng* epidemiology and management.

4. ENTOMOLOGY

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

I. NORTH WEST ZONE

1. RRS (PAU), Kapurthala (Punjab)

The early shoot borer incidence was found to be low in all the tested genotypes *viz.* CoH 12026, Co 12027, CoH 12261, CoLk 12201, CoLk 12202, CoLk 12203, CoPant 12221, CoPant 12222, CoS 12231, CoH 11262, CoLk 11201, CoLk 11202, CoLk 11203, Co 10035, CoH 10261, CoS 10231, Co 12028, Co 12029, CoH 12263, CoLk 12205, CoLk 12206, CoPant 12224, CoPant 12226, CoPb 12181, CoPb 12182, CoPb 12211, CoPb 12212, CoS 12232, Co 11027, CoH 11263, CoLk 11204, CoLk 11206, CoPb 11214, CoPb 11232, Co 10036, CoH 10262, CoPant 10221, CoPb 10181 and CoPb 10182. Moreover, genotype *viz*., CoLk 12204 (IVT E), Co Pant 12221 (IVT E), CoH 12262 (IVT ML), CoPant 12223 (IVT ML) and CoPant 12225 (IVT ML) showed moderately susceptible to early shoot borer. The cumulative incidence of top borer was recorded as less susceptible to moderately susceptible. However, it ranged from 5.56 per cent in CoH 11262 (AVT E I) to 11.94 per cent in CoLk 12204 (IVT E) in all the genotypes evaluated which exhibited low to moderately susceptible reaction against top borer. The per cent incidence of stalk borer ranged from 6.67 per cent in CoPant 12222 (IVT E) to 16.00 per cent in CoPb 12211 (AVT ML). However, the genotypes under six different group showed less susceptible reaction to stalk borer.

2. RRS, Uchani, Karnal (Haryana)

Report not submitted.

3. ICAR-SBI Coimbatore Regional Centre, Karnal (Haryana)

AVT (Ratoon)

All the tested genotypes *viz*. Co 10035, CoH 10261, CoS 10231, CoH 10262, CoPant 10221, CoPb 1018, Co 10036 and CoPb 10182 showed less susceptible reaction to black bug, early shoot borer and top borer. These genotypes were also less susceptible to shoot borer. In case of root borer, one genotype, Co 10036 showed moderately susceptible reaction, whereas seven genotypes; Co 10035, CoH 10261, CoS 10231, CoH 10262, CoPant 10221, CoPb 10181 and CoPb 10182 were highly susceptible.

AVT (I Plant)

All the tested genotypes; CoS 11232, CoPb 11214, CoH 11262, CoLk 11204, CoH 11263, Co 11027, CoLk 11203, CoLk 11202, CoLk 11201 and CoLk 11206 showed less susceptible reaction to early shoot borer and top borer. These genotypes were also less susceptible to shoot borer. In case of root borer, four genotypes *viz.*, CoLk 11204, CoH 11263, Co 11027 and CoLk 11202 exhibited moderately susceptible reaction whereas six genotypes *viz*., CoS 11232, CoPb 11214, CoLk 11206, CoLk 11203, CoLk 11201 and CoH 11262 were highly susceptible.

AVT (II Plant)

All the tested genotypes showed less susceptible reaction to early shoot borer and top borer. One genotype; CoPant 10221 exhibited moderately susceptible reaction to root borer while seven genotypes *viz*., CoPb 10182, CoPb 10181, CoH 10262, Co 10036, CoS 10231, CoH 10261 and Co 10035 were highly susceptible. In case of shoot borer, six genotypes; (CoPb 10182, CoPant 10221, CoH 10262, Co 10036, CoH 10261 and Co 10035) showed less susceptible reaction whereas, two genotypes; CoPb 10181 and CoS 10231 exhibited moderately susceptible reaction.

4. U.P. Council Sugarcane Research, Shahjahanpur (U.P.)

AVT (Mid-late) -I Plant

Based on cumulative incidence of shoot borer only the variety Co 11027 showed less susceptibility (8.50%) while rest of the varieties including standard showed moderate susceptible to shoot borer and ranged from 17.18 per cent in CoS 11232 to 25.97 per cent in CoS 767. At harvest, the varieties Co 11027 (12.00%), CoLk 11204 (14.67%), CoPant 97222 (14.67%) and CoLk 11206 (17.33%) showed moderate susceptible reaction while the varieties CoS 767 (21.33%), CoS 8436 (21.33%), CoH 11263 (25.33%), CoPb 11214 (28.00%) and CoS 11232 (32.00%) showed highly susceptible reaction to top borer. The stalk borer infestation ranged from 0.41 in CoLk 11206 to 1.36 in CoPant 97222 and showed less susceptible reaction.

AVT (Mid-late) -II Plant

Based on cumulative incidence of shoot borer, the varieties *viz*., CoPb 10182 (22.16%), CoS 767 (25.76%), Co 10036 (26.44%), CoPant 10221 (26.69%) and CoH 10262 (29.71%) showed moderate susceptible while the varieties CoS 8436 (30.27%), CoPant 97222 (34.36%) and CoPb 10181 (39.63%) showed highly susceptible reaction to shoot borer. At harvest, the varieties CoPb 10181 (16.00%), CoPb 10182 (18.67%) and CoPant 97222 (13.33%) showed moderate susceptible while rest of the varieties CoH 10262 (21.33%), CoPant 10221 (26.67%), Co 10036 (26.67%), CoS 767 (26.67%) and CoS 8436 (21.33%) registered highly susceptible reaction to top borer. In case of stalk borer infestation, variety CoPant 97222 (2.32%) noted moderately susceptible reaction while rest of the varieties CoS 767 and CoS 8436 showed less susceptible reaction to stalk borer.

AVT (Early)-I Plant

Based on cumulative incidence of shoot borer, the varieties CoLk 11201 (28.28%), CoLk 11203 (19.41%), Co 0238 (21.76%) and CoJ 64 (25.00%) showed moderate susceptible reaction while the varieties CoLk 11202 (32.73%) and CoH 11262 (37.26%) showed highly susceptible reaction to shoot borer. At harvest, only the standard variety CoJ 64 (17.33%) showed moderately susceptible reaction while rest of the variety CoLk 11201 (24.00%), CoLk 11202 (36.00%), CoLk 11203 (24.00%) and CoH 11262 (38.67%) and Co 0238 (40.00%) showed highly susceptible reaction to top borer. The stalk borer infestation showed less susceptible reaction and infestation index ranged from 0.32 in CoJ 64 to 1.46 in CoH 11262.

AVT (Early)-II Plant

Based on cumulative incidence of shoot borer, all the varieties CoS 10231 (22.22%), CoH 10261 (28.87%), Co 10035 (29.29%), CoPant 84211 (28.81%) and CoJ 64 (27.31%) showed moderate susceptible reaction to shoot borer. At harvest, the varieties CoH 10261 (16.00%) and CoPant 84211 (13.33%) showed moderate susceptible reaction while the varieties CoS 10231 (21.33%), Co 10035 (25.33%) and CoJ 64 (33.33%) showed highly susceptible reaction to top borer. The stalk borer infestation exhibited less susceptible reaction to stalk borer and infestation index ranged from 0.83 in CoS 10231 to 1.96 in CoH 10261.

AVT (Mid-late)–Ratoon

Based on cumulative incidence of shoot borer, all the varieties CoPb 10181 (29.77%), CoPb 10182 (27.27%), CoH 10262 (27.93%), Co 10036 (25.06%), CoS 767 (20.47%), CoS 8436 (26.03%) and CoPant 97222 (26.85%) showed moderate susceptible reaction while only one variety CoPant 10221 (36.96%) showed highly susceptible reaction to shoot borer. At harvest, the varieties CoPb 10181 (17.33%), CoPant 10221 (18.67%) and CoPant 97222 (13.33%) showed moderately susceptible while the varieties CoPb 10182 (22.67%), CoH 10262 (22.67%), Co 10036 (24.00%), CoS 767 (24.00) and CoS 8436 showed highly susceptible reaction to top borer. The standard variety CoPant 97222 (2.23%) showed moderately susceptible reaction while rest of the varieties gave less susceptible reaction to stalk borer infestation.

AVT (Mid-late)–Ratoon

The variety Co 10035 (14.14%) showed less susceptible reaction while rest of the varieties CoS 10231 (18.56%), CoH 10261 (24.71%), CoPant 84211 (26.66%) and CoJ 64 (23.07%) showed moderate susceptible reaction to shoot borer. At harvest, the varieties CoH 10261 (17.33%), Co 10035 (18.67%) and CoPant 84211 (17.33%) showed moderately susceptible reaction while the varieties CoS 10231 (21.33%) and CoJ 64 (26.67%) showed highly susceptible reaction to top borer. The variety CoH 10261 (2.14) showed moderate susceptible reaction while rest of the varieties showed less susceptible reaction to stalk borer.

5. IISR, Lucknow (U.P.)

AVT (Early)

The incidence of top borer (III and IV brood) ranged from 2.27 to 14.87 and 6.25 to 53.32 per cent, respectively. The incidence and intensity of internode borer ranged 3.33 to 14.57 and 1.60 to 6.48 per cent, respectively. The infestation index was higher (6.48%) in CoH10261. The incidence and intensity of stalk borer ranged from 0.95 to 13.48 and 1.60 to 3.58 per cent, respectively. Genotypes *viz*., CoLk11202 and CoLk11203 showed moderately susceptible reaction and rest of the genotypes showed less susceptible reaction to III brood of top borer. CoS10231 showed less susceptible reaction to IV brood of top borer and rest of the genotypes showed less susceptible reaction. CoH10261 and CoS10231 were highly susceptible and rest of the genotypes moderately susceptible to stalk borer. Genotype *viz*., CoS10231 and CoLk11201

exhibited less susceptible and rest of the genotypes showed moderately susceptible reaction to internode borer.

AVT (Mid-late)

The incidence of III and IV brood of top borer ranged from 3.16 to 16.43 and 6.21 to 43.93 per cent, respectively. The incidence and intensity of internode borer ranged from 3.33 to 14.57 per cent and 1.55 to 6.60, respectively. The incidence and intensity of stalk borer ranged from 0.95 to 14.57 and 1.41 to 5.28 per cent, respectively. The genotype CoLk11206 noted moderately susceptible reaction and rests of the genotypes were less susceptible to top borer (III brood). All genotypes were found less susceptible to internode borer.

II. NORTH CENTRAL ZONE AND EASTERN ZONE

6. SRI (RAU), Pusa (Bihar)

The cumulative incidence of early shoot borer was recorded as lowest (9.52 %) in variety CoP 11439 under AVT ML I P and highest (16.50%) in variety CoSe 95422 under IVT E. The genotype tested under different maturity groups are graded as less to moderately susceptible reaction against early shoot borer. While, incidence of root borer was found minimum (7.15%) in variety CoP 12437 (IVT E) and maximum (10.74%) in variety CoSe 92423 graded as less susceptible reaction. The incidence of top borer was recorded as low to moderate which varied 6.85 per cent in variety BO 155 (IVT ML I P) and 9.44 per cent in variety Colk 12209 (IVT M) against III brood, while 8.36 per cent in variety CoSe 10451 (AVT E I P) and 11.35 per cent in variety Colk 12209 (IVT ML) against IV brood of top borer. All the genotypes evaluated under different maturity groups exhibited less to moderately susceptible reaction against top borer based on IV brood incidence. The stalk borer infestation index varied from traces to 0.63 per cent and showed less susceptible reaction for all the tested genotypes.

7. G.S. Sugarcane Breeding and Research Station, Seorahi (U.P.)

AVT (Mid-late)-I Plant

Based on cumulative incidence of shoot borer all the varieties including standards showed less susceptible reaction to shoot borer and ranged from 5.66 per cent in CoSe 11454 to 11.11 per cent in BO 155. The stalk borer infestation ranged from 0.05 in CoSe 11453 to 0.13 in CoSe 11455. All the genotypes including standards showed less susceptible to stalk borer and root borer.

AVT (Early)-I Plant

The cumulative incidence of shoot borer showed less susceptible reaction and it was minimum (7.77%) in CoP 11436 and maximum (9.80%) in CoSe 95422. At harvest, all the varieties showed less susceptible reaction to top borer and ranged from 6.25 per cent in CoP 11436 to 9.60 per cent in BO130. The stalk borer infestation showed less susceptible reaction. Moreover, all the varieties showed less susceptible to root borer.

AVT (Mid-late)-II Plant

Based on cumulative incidence of shoot borer, all the varieties showed less susceptible reaction to shoot borer and it was minimum (6.81%) in CoP9301 and maximum (9.02%) in CoSe 10452. At harvest, all the varieties including standard showed less susceptible reaction to top borer which ranged from 4.72 per cent in CoSe 10453 to 6.66 per cent in BO 91. The stalk borer and root borer showed less susceptible reaction.

III. PENINSULAR ZONE

8. SRS, Dr. PDKV, Akola (M.S.)

All the genotypes showed less susceptible reaction to early shoot borer and ranged from 2.65 to 9.59 per cent. The infestation of scales ranged from 6.03 per cent to 19.64 per cent intensity indicating less susceptible to moderately susceptible and the infestation of pyrilla in all varieties ranged from 0.30 to 0.80 per leaf indicating less susceptible reaction.

9. CSRS, MPKV, Padegaon (M.S.)

AVT (Early) -II Plant

None of the entries showed less susceptible reaction to early shoot borer, internode borer as well as mealy bug, whereas only one entry Co 09004 showed less susceptible reaction to scale insect (0.00%). The entry CoN 09072 showed least incidence to early shoot borer (17.28 %) as well as internode borer (23.33%) and highest intensity of mealy bug (18.59%). The genotype Co 94008 showed highest incidence of early shoot borer (34.71%) and least incidence of mealy bug (43.33%). The cumulative per cent infestation of early shoot borer ranged from 17.28 to 34.71 per cent. The internode borer incidence ranged from 23.33 to 63.33 per cent. It was observed that there was no incidence of top shoot borer in all entries. The mealy bug incidence ranged from 43.33 to 86.67 per cent. All test genotypes recorded highly susceptible reaction to mealy bug. In case of scale insect, the incidence ranged from 0 to 50 per cent.

AVT (Early)-I Plant

All tested genotypes recorded highly susceptible reaction to mealy bug. The genotypes *i.e.* Co 10005 (12.63%) and Co 10027 (14.34%) showed less susceptible reaction to early shoot borer. The variety Co 85004 showed less susceptible reaction (3.33%) to scale insect. The Co 10026 showed least incidence of mealy bug (46.67 %) and highest incidence of internode borer (70%). The variety Co 85004 showed least incidence to internode borer (30%), where as highest incidence of mealy bug (90%). The cumulative per cent infestation of early shoot borer ranged from 12.63 to 30.23 per cent. The internode borer ranged from 30 to 70 per cent. The mealy bug incidence ranged from 46.67 to 90 per cent.

AVT (Mid-late)-I Plant

All test genotypes observed highly susceptible reaction to mealy bug. The genotypes Co 09009 recorded highest incidence of early shoot borer (32.82%) as well

as scale insect (43.33%) whereas least incidence to mealy bug (40%). The genotypes Co 10015 recorded least incidence to early shoot borer (15.19%), whereas the highest incidence to scale insect (43.33%). The entry Co 10033 recorded least incidence of internode borer (36.67%) as well as scale insect. The cumulative per cent infestation of early shoot borer ranged from 15.19 to 32.82 per cent. The incidence ranged from 36.67 to 80 per cent. The mealy bug incidence ranged from 40 to 96.67 per cent. Scale insect incidence ranged from 0 to 43.33 per cent.

IVT (Early)

All test genotypes showed highly susceptible reaction to mealy bug. The entry Co 12008 showed least incidence to early shoot borer (8.26%) as well as scale insect. The entry CoT 12367 recorded highest incidence of internode borer (76.67%), mealy bug as well as highest intensity of scale insect (5.55%). The variety Co 94008 recorded least incidence of internode borer (36.67%) as well as mealy bug (76.67%), whereas highest incidence of early shoot borer (38.28%). The cumulative per cent infestation of early shoot borer ranged from 8.26 to 38.28 per cent. The incidence ranged from 36.67 to 76.67 per cent. The mealy bug incidence ranged from 76.67 to cent per cent. The incidence of scale insect ranged from 0 to 50 per cent.

IVT (Mid-late)

All test genotypes recorded highly susceptible reaction to mealy bug. The entry Co 12012 showed least infestation index to internode borer (0.86%), whereas the highest incidence to scale insect (43.33%). The entry Co 12024 recorded highest incidence to early shoot borer (33.33%) as well as mealy bug (100%). The entry CoM 12085 recorded least incidence to internode borer (36.67%), whereas highest incidence of mealy bug (cent per cent). The cumulative per cent infestation of early shoot borer ranged from 16.02 to 33.33 per cent. The incidence ranged from 36.67 to 73.33 per cent. The mealy bug incidence ranged from 76.67 to cent per cent. The incidence of scale insect ranged from 0 to 43.33 per cent.

AVT (Early)–Ratoon

The entry CoN 09072 showed least incidence to scale insect (77.50%), whereas highest incidence to early shoot borer (12.56%), as well as mealy bug (100%). The variety Co 85004 showed least incidence to internode borer (27.50%), whereas highest incidence to mealy bug as well as scale insect (100%). The cumulative per cent infestation of early shoot borer ranged from 9.51 to 12.56 per cent. The incidence ranged from 27.50 to 45 per cent. The mealy bug incidence ranged from 92.50 to 95.0 per cent. The scale insect incidence ranged from 77.50 to cent per cent.

10. Vasantdada Sugar Institute (VSI), Pune (M.S.)

IVT (Early)

Genotypes *viz*., CoC 671, Co 12006, CoT 12367 and Co 94008 showed moderately susceptible reaction to early shoot borer, while all varieties/genotypes showed less susceptible reaction to internode borer and mealy bug.

AVT (Early)-I Plant

Genotypes *viz*., Co 10004, Co 10024, Co 10026 and Co 85004 showed less susceptible reaction to early shoot borer, while all varieties/genotypes showed less susceptible reaction to internode borer. The genotype Co 10006, Co 10024, Co 10026 and Co 94008 showed less susceptible reaction to mealy bug.

AVT (Early)-II Plant

The varieties/genotypes *viz*., Co 09007 and Co 85004 showed less susceptible reaction to early shoot borer, whereas all varieties/genotypes showed less susceptible reaction to internode borer and moderately susceptible reaction to mealy bug.

AVT (Early)–Ratoon

All genotypes showed less susceptible reaction to early shoot borer, internode borer and scale insect. Genotype *viz*., Co 09004 and Co 94008 showed less susceptible reaction to mealy bug.

IVT (Mid-late)

The genotype Co 12024 was found highly susceptible to early shoot borer, while all genotypes showed less susceptible reaction to internode borer and Co 12016, Co 12024 and CoN 12073 showed moderately susceptible reaction to mealy bug.

AVT (Mid-late)-I Plant

The genotypes *viz*., Co 10017, Co 10031, Co 10033, CoT 10369, Co 86032 and Co 99004 found less susceptible to early shoot borer, while all 13 varieties/genotypes showed less susceptible reaction to internode borer and Co 09009, Co 10033 and CoT 10368 were free from mealy bug infestation.

11. ZARS, JNKVV, Powarkheda (M.P.)

The genotypes *viz*., Co 80004 and CoJN 86-141 graded as least susceptible (LS), while all remaining were moderate susceptible. Among the midlate group entries, Co 12024, Co 12012 and Co 12019 (7.89 to 10.27%) showed less susceptible to early shoot borer as compared to all the check varieties. The pyrilla incidence ranged from 9.65 to 18.63 individuals per leaf in various tested genotypes. All the evaluated genotypes and checks were graded as moderately susceptible. In the Midlate group, the pyrilla per leaf population ranged from 9.87 to 19.10 individuals/leaf in various genotypes/ varieties. All the evaluated genotypes and checks were graded as moderately susceptible.

12. MSRS, NAU., Navsari (Gujarat)

IVT (Early)

The cumulative per cent infestation of early shoot borer ranged from 1.17 to 4.09 per cent. Thus, all the tested genotypes showed less susceptible reaction to early shoot borer. Whereas, the per cent incidence of top borer at harvest ranged from 1.52 to 4.20 per cent. The least incidence was observed in Co 85004 (1.52 %) and maximum incidence was observed in CoM 12081 (4.20 %). Thus, all the tested genotypes exhibited susceptible reaction to top borer. The incidence of stalk borer ranged from

4.00 to 28.00 per cent. The least per cent incidence of stalk borer was observed in Co 12001 (4.00%), while maximum incidence was observed in Co 94008 (28.00%). Thus, all the tested genotypes showed less to moderately susceptible reaction to stalk borer. The least per cent incidence of internode borer was observed in Co 12003 (0.00%), while maximum incidence was observed in Co 85004 and CoC 671 (16.00%). Thus, all the tested genotypes showed less susceptible reaction to internode borer. The least per cent incidence of root borer was observed in Co 12003 and CoN 12072 (12.00%), while maximum incidence was observed in Co 12007 (28.00%). Thus, all the tested genotypes showed less to moderately susceptible reaction to root borer. The least incidence (0.00 %) was observed in 10 genotypes out of 15 including checks, while maximum incidence was observed in Co T 12367 (36.0%). Thus, all the tested genotypes showed less susceptible reaction to scale insect. The least incidence of mealy bug was observed in Co 12001, Co12006, Co N 12071 and Co N 12072 (16.00 %) while maximum incidence was observed in CoT 12366, CoT 12367 and Co 94008 (28.00 %). Thus, all the tested genotypes showed moderately susceptible reaction to mealy bug.

AVT (Early)-I Plant

Based on the cumulative per cent incidence of early shoot borer, the least incidence was observed in CoT 10366 (1.00 %) while, maximum incidence was observed in Co 10005 (6.55%). Thus, all the tested genotypes showed less susceptible reaction to early shoot borer. Based on the per cent incidence of top borer at harvest, the least per cent incidence was observed in Co 85004 (1.52 %), while maximum incidence was observed in CoT 10367 (10.35 %). Thus, all the tested genotypes showed less to moderately susceptible reaction to top borer. The least per cent incidence of stalk borer was observed in CoT 10366 (8.00%), while maximum incidence was observed in Co 10006 (20.00%). Thus, all the tested genotypes showed less to moderately susceptible reaction to stalk borer. The least per cent incidence of internode borer was observed in CoT 10366 (8.00%), while maximum incidence was observed in Co 10004 (20.25%). Thus, all the tested genotypes showed less to moderately susceptible reaction to internode borer. The least per cent incidence of root borer was observed in Co 85004, Co 94008 and CoC 671 (20.00%), while maximum incidence was observed in Co 10006 and Co 10027 (24.65%). Thus, all the tested genotypes showed moderately susceptible reaction to root borer. The per cent incidence was nil in Co 10024, Co10027, CoT 10366 and Co 671 while it was maximum (40.0%) in Co85004 and Co94008. Thus, all the tested genotypes showed less to highly susceptible reaction to scale insect. The least incidence of mealy bug was observed in Co 10006 while maximum per cent incidence was observed in Co 94008 (72 %). Thus, all the tested genotypes showed moderately to highly susceptible reaction to mealy bug.

AVT (Early)-II Plant

Based on the cumulative per cent incidence of early shoot borer, the minimum incidence was observed in Co 09007 (1.21 %) while, maximum incidence was observed in Co 85004 (4.09%). The per cent incidence of top borer at harvest was lowest in observed in Co 09004 (1.47 %) while highest incidence was observed in CoC 671 (1.72

%). Thus, all the tested genotypes showed less susceptible reaction to early shoot borer and top borer. The least per cent incidence of stalk borer was observed in Co 09007 and Co 94008 (12.00%), while maximum incidence was observed in Co 09004 (20.00%). Thus, all the tested genotypes showed less to moderately susceptible reaction to stalk borer. The per cent incidence of internode borer was ranged from 12.00 % to 16 % per cent. Thus, all the tested genotypes showed less susceptible reaction to internode borer. The least per cent incidence of root borer was observed in CoN 09072, while rest of the genotype exhibited maximum incidence (20.00%). Thus, all the tested genotypes showed moderately susceptible reaction to root borer. The per cent incidence scale insect was observed as zero in Co 09004, CoN 09072 and CoC 671 while it was maximum (40.0%) in Co 85004 and Co 94008. Thus, all the tested genotypes showed less to highly susceptible reaction to scale insect. The least incidence (20.00 %) was observed in CoN 09072 and CoC 671 while the maximum per cent incidence was observed in Co 94008 (72 %). Thus, all the tested genotypes showed moderately to highly susceptible reaction to mealy bug.

IVT (Mid-late)

Based on the cumulative per cent incidence of early shoot borer, the least incidence was observed in Co 86032 (0.20 %) while, maximum incidence was observed in Co 12017 (6.21 %). The per cent incidence of top borer at harvest was ranged from 0.00 to 8.00 per cent. Thus, all the tested genotypes showed less susceptible reaction to early shoot borer and top borer. The incidence of stalk borer was ranged from 16.00 to 24.00 per cent with maximum incidence in Co 12024, CoM 12086, CoT 12368 and Co 99004 (24.00%). The incidence of internode borer was ranged from 4.00 % to 12.00 % per cent. The incidence of root borer ranged from 16.00 to 24.00 per cent. The highest per cent incidence was observed in Co 12024, Co M 12086 and CoT 12368 (24.00 %). Thus, all the tested genotypes showed moderately susceptible reaction to stalk borer and root borer while it was less susceptible reaction to internode borer. The incidence of scale insect varied from 0.00 to 4.00 per cent with the maximum incidence in CoM 12085 (4.00%). The incidence of mealy bugs ranged from 20.00 to 60.00 per cent with maximum per cent incidence in Co 12017 (60.00%). Thus, all the tested genotypes showed less susceptible reaction to scale insect while it was moderately to highly susceptible reaction to mealy bug.

AVT (Mid-late)

The cumulative per cent incidence was least incidence in Co 10031 (0.65 %) while it was maximum in PI 10131 (4.18 %). The incidence of top borer ranged from 0.75 to 2.16 per cent with highest incidence was observed in PI 10131 (2.16 %). Thus, all the tested genotypes showed less to moderately susceptible reaction to early shoot borer and top borer.

The per cent incidence was ranged from 16.00 to 32.00 per cent with maximum in PI 10131 (32.0%). The incidence of internode borer was ranged from 0.00 % to 16.00 % per cent.

The per cent incidence of root borer ranged from 16.00 to 24.00 per cent with highest in Co 09009, Co 10033 and PI 10131 (24.00 %). Thus, all the tested genotypes

showed less to moderately susceptible reaction to stalk borer. Moreover, it was less susceptible reaction to internode borer and moderately susceptible reaction to root borer. The incidence of scale insect varied from 0.00 to 40.00 per cent with maximum in Co 10033, Co T 10368, CoT 10369 and PI 10131 (40.00%). The incidence of mealy bug was 40.00 per cent in all the genotypes. Thus, all the tested genotypes showed less to highly susceptible reaction to scale insect while it was highly susceptible reaction to mealy bug.

13. ZARS, UAS, Mandya (Karnataka)

Among the genotypes screened under different categories, all genotypes showed less susceptible reaction against early shoot borer and top shoot borer and while twenty five genotypes showed less susceptible reaction against internode borer.

14. Regional Sugarcane & Jaggery Research Station, Kolhapur (M.S.)

Report not submitted.

15. ICAR-SBI, Coimbatore (T.N.)

IVT (Early)

All the genotypes showed less susceptible reaction to early shoot borer. The lowest incidence of internode borer was noted in Co 12003 (24.0%) while it was highest in Co 12006 (52.0%). The incidence of the root borer and top borer was nil.

AVT (Early)-I Plant

All the entries were less susceptible to early shoot borer and incidence ranged between 2.26 per cent in Co 10004 and 12.0 per cent in Co 94008. All the genotypes/varieties showed highly susceptible reaction except genotype CoT 10367, CoC 671 and Co 85004 recorded moderately susceptible reaction to internode borer. The incidence of the root borer was nil while all the tested genotypes under the group showed less to moderately susceptible reaction to top borer.

IVT (Mid-late)

All the entries showed less susceptible reaction to early shoot borer and incidence ranged from 1.43 per cent in Co 12014 to 6.11 per cent in VSI 12121. All the tested genotypes under the group showed moderately to highly susceptible reaction to internode borer. The root borer incidence was varied from 0.00 per cent in entries CoM 12084, Co 12121, Co 86032 and Co 0212, to 29.6 per cent in Co 12024. Moreover, all the entries except Co 12012 showed less susceptible reaction to the top borer.

AVT (Mid-late)-I Plant

All the entries showed less susceptible reaction to early shoot borer and varied from 0.93 (Co 10017) to 6.23 per cent (Co 86032). All the tested genotypes under the group showed moderately to highly susceptible reaction to internode borer. Moreover, it showed less to moderately susceptible reaction to top borer. The incidence of the root borer was nil.

AVT (Early)-II Plant

All the genotypes showed less susceptible reaction to early shoot borer. The entry CoN 09072 recorded the lowest incidence (20%) in CoN 09072 to highest in Co 94008 (73.21%) and showed less to highly susceptible reaction to internode borer. The incidence of root borer was nil while all the entries showed less susceptible reaction to the top borer.

IV. EAST COAST ZONE

16. RARS, ANGRAU, Anakapalle (A.P.)

IVT (Early)

The genotype Co A 13 324 recorded significantly less incidence of early shoot borer (12.23%), internode borer (33.33%) and found less susceptible to early shoot borer and moderately susceptible to internode borer, whereas the entry, Co A 13 322 with 63.33 per cent incidence showed highly susceptible reaction to internode borer. However, very less incidence of scale insect was recorded on all the tested entries.

IVT (Mid-late)

The genotype Co A 13 327 (9.62%DH) and Co A 13 328 (10.69%DH) showed less susceptible reaction to early shoot borer and Co A 13 328 showed moderately susceptible reaction to internode borer (23.47%). Whereas, two entries Co A 13336 (0%) and Co A 13 337 (3.33%) showed less susceptible reaction to scale insect.

AVT (Early)

The entries Co V 12 356 (6.69 % DH) and Co A 12 322 (6.82%DH) recorded lowest cumulative incidence of early shoot borer. However, all the tested entries recorded less susceptible reaction to early shoot borer, whereas all the entries showed highly susceptible reaction to internode borer (43.33 % to 76.67 %) and scale insect (30% to 83.33%).

17. Sugarcane Research Station, Vuyyuru (A.P.)

All the screened genotypes showed less susceptible reaction to early shoot borer. Moreover, all tested genotypes exhibited moderately to highly susceptible reaction to internode borer. Thus, all the tested genotypes noted less to highly susceptible reaction to scale insect.

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

1. Regional Research Station, PAU., Kapurthala (Punjab)

Incidence of termite ranged between 2-3 per cent in popular varieties of sugarcane *viz.*, Co 238, CoH 89003 and CoJ 64 around sugar factories at Dhuri, Faridkot and Fazilka. The incidence of early shoot borer, top borer, stalk borer and root borer ranged between 3-4, 2-3, 7-8 and 2-3 per cent, respectively, in different varieties of sugarcane *viz.*, CoJ 85, CoJ 64, CoJ 88, Co 238, CoS 8436, CoH 89003 at different cane growing areas of Punjab.

2. Regional Research Station, Uchani Dist- Karnal (Haryana)

Report not submitted.

3. ICAR-SBI Coimbatore Regional Centre, Karnal (Haryana)

The incidence of early shoot borer, top borer and root borer was below 15.0, 10.0 and 30.0 per cent, respectively. The severe incidence of red webbing mite (80.5%) was recorded in some of the plots of variety Co 89003 in Karnal area. The mean population of pyrilla was 2.2 to 12.5/ leaf in different varieties. Incidence of pink borer was recorded as 10.0 per cent in July planted sugarcane variety Co 05011. The stalk borer infestation index was less than 2 in all the varieties; Co 0238, CoH 119, Co 89003, Co 05011 and Co 89003, except CoS 8436 (2.6). Early shoot borer, top borer, stalk borer, black bug, pyrilla and white grub were identified as key pests and army worm, mealy bugs, whitefly and thrips as occasional pests of sugarcane.

4. U.P. Council of Sugarcane Research, Shahjahanpur (U.P.)

During hot weather, the incidence of early shoot borer was low and ranged from 6.00 per cent (Nigohi and Ajbapur factory zone) to 11.50 per cent (Sultanpur factory zone). The maximum population of pyrilla was 40 (nymph + adult) /leaf in and around Nigohi factory zones while the maximum [17.50 pyrilla (nymph + adult) / leaf] was observed around Hargaon factory zones during 2nd week of April. The occurrence of *Epiricania melanoleuca* was negligible in most of the fields. The per cent incidence of top borer was recorded low to moderate in all surveyed sugar factory zone. The minimum (8.00%) incidence of top borer was recorded around Ajbapur factory zone while maximum (15.00%) around Tilhar factory zone. The infestation of stalk borer was recorded low in all surveyed factory zone and ranged from 12.50 per cent on cane basis around Hargaon factory zone (5.55% intensity) to 18.00 per cent on cane basis around Tilhar factory zone.

5. SRI, RAU, Pusa (Bihar)

The percent incidence of early shoot borer (5 to 17%), root borer (3 to 8%), top borer (8 to 20%), stalk borer (below 10%), army worm (3 to 25%) and pyrilla (15 to 85) per leaf were observed as the key pests of sugar factory area of sugarcane .The incidence of other pest like plassey borer, mealy bug, termite, grass hopper, scale insect, whitefly, etc. were also recorded in traces. Besides, roving survey was also conducted at sugarcane field in and around Pusa at monthly interval.

6. G.S. Sugarcane Breeding and Research Station, Seorahi (U.P.)

During hot weather, the incidence of early Shoot borer was low and ranged from 2.00 per cent in Ramkola factory zone to 9.00 per cent in Seorahi factory zone. The per cent incidence of top borer was recorded as low in all surveyed factory zones. The minimum (4.00%) incidence of top borer was recorded around Mankapur and Ramkola factory zone while maximum (10.00%) around Babhnan factory zone. The infestation of stalk borer was observed low in all surveyed factory zone and ranged from 4.50 per cent around Sathiaon to 8.00 per cent on cane basis in Babhanan factory zone. The incidence of root borer was observed low and ranged from 3.50 per cent in Sathiaon factory zone to 7.00 per cent in Dhadha factory zone.

7. SRS, Dr. PDKV, Akola (M.S.)

The results of experiment were not submitted by concern centre.

8. CSRS, MPKV, Padegaon (M.S.)

Early shoot borer is key pest of this area and per cent insect infestation was highest in *suru* planting than *adsali* and *preseasonal.* The incidence of early shoot borer ranged from 09.40 to 38.80 per cent, where as average incidence was recorded 12.60 per cent. The per cent incidence of internode borer ranged from15.20 to 24.60 and intensity ranged from 2 to 8 per cent. The incidence of mealy bug was ranged from 20.40 to 25.80 per cent, whereas intensity ranged from 2 to 5 per cent. The incidence of top shoot borer, root borer, sugarcane woolly aphid, pyrilla, whitefly, thrips, scale insects, white grub and termites were in traces to low level.

9. Vasantdada Sugar Institute (VSI), Pune (M.S.)

The incidence of early shoot borer was minimum 4.10 per cent in CoM 0265 and maximum 29.40 per cent in Co VSI 9805. The incidence of ESB was more in sugarcane planted in March month. The incidence of internode borer and mealy bug was more in sugarcane planted in *adsali* season as compared to sugarcane planted in *suru* season.

10. ZARS, JNKVV, Powarkheda (M.P.)

The pyrilla and early shoot borer were reported as key pests, while the top shoot borer, root borer, pink stem borer, whitefly, mealy bug and scale insect were minor insect pests of sugarcane. Among the areas surveyed, the highest infestation of early shoot borer recorded at Salichouka sugar factory area, while maximum infestation of pyrilla observed at Kareli factory areas.

11. MSRS, NAU., Navsari (Gujarat)

The incidence of early shoot borer and top borer was ranged 7.0 to 12.0 per cent in Co 86032, Co 97009, CoC 671, Co 86032, Co 86002, CoM 0265, and CoSi 95071.

12. ZARS, UAS, Mandya (Karnataka)

The incidence of early shoot borer, top shoot borer and internode borer was ranged from 12.0-17.0, 14.50-16.0, 12.0-16.0 per cent, respectively. The incidence of pyrilla, mites, woolly aphid and root grub were found to be low in certain cane growing areas.

13. ICAR-SBI, Coimbatore (T.N.)

The per cent incidence of internode borer (5.0-50.0%), top borer (0.00-5.00%), root borer (0.00-15.00%) were observed as the key pests of sugar factory area of sugarcane. The incidence of other pests like Termite, Mealybug, Pyrilla and Rat, etc were also recorded in traces.

14. RARS, ANGRAU, Anakapalle (A.P.)

The per cent incidence of internode borer was more on early planted crop and it was ranged from 15 to 85 per cent on all popular sugarcane varieties (87 A 298, 2003 V 46, 2001 A 63 and Co 86032). The moderate to severe incidence of red mite (4 to

45%) was observed during the months of May, June and July months due to high temperature and late onset of monsoon.

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

1. Regional Research Station, PAU., Kapurthala (Punjab)

The parasitoid *viz., Trichogramma sp*. and *Stenobracon sp*. were recorded as 4.6 and 1.3 per cent, respectively in the month of May and 2.2 and 3.1 per cent respectively in the month of June. The top borer incidence started from month of May and reached to its peak level of 9.8 per cent in 1st week of July. Thereafter, top borer incidence decreased to 2.8 per cent in the 1st fortnight of September. The bio-agents *viz., Rhaconotus* sp., *Isotima javensis* and *Stenobracon* sp. were recorded as 4.3, 3.1 and 3.8 per cent in the month of July, respectively and 2.1, 1.2 and 2.6 per cent in the month of August, respectively. The stalk borer incidence started from second week of September and reached to its peak level of 9.3 per cent in the month of November and thereafter, stalk borer incidence declined. Parasitization by bio-agents *viz*., *Sturmiopsis inference* and *Cotesia flavipes* were observed 2.8 and 3.0 percent in the month of October, respectively and again *Sturmiopsis inference* and *Cotesia flavipes* were observed 3.6 and 1.0 percent in the month of November. The activity of pyrilla on sugarcane initiated from first week of August and continued up to first fortnight of October. Activity of bio-agent *viz., Epiricania melanoleuca* 3.8 per cent parasitization was observed in the month of August, 2.0 per cent was observed in the month of September and 1.4 per cent observed in month of October.

2. Regional Research Station, Uchani Dist- Karnal (Haryana)

Report not submitted.

3. ICAR-SBI Coimbatore Regional Centre, Karnal (Haryana)

Epiricania melanoleuca was identified as effective parasitoid of pyrilla adult's and nymphs (27.2%) and *Tetrasticus pyrillae* was identified as eggs parasitoid of pyrilla (3.6%). The parasitoid, *Cotesia flavipes* was also identified as an effective parasitoid of stalk borer larvae (4.6%).

4. U.P. Council of Sugarcane Research, Shahjahanpur (U.P.)

The population of pyrilla was started 15.00 (nymph + adult)/leaf during 16th SMW which increases 55 (nymph + adult)/leaf during 32nd SMW. Then, population was sharply declined up to 8.50 (nymph + adult)/ leaf during 35th SMW due to parasitisation of *E. melanoleuca* and *Tetrastichus pyrillae*. The bioagents viz., *Isotima javensis*, *Telenomus beneficiens*, *Rhaconotus scirpophagae* and *Stenobracon deesae* were recorded as major parasitoids of top borer. The parasitoid, *Cotesia flavipes*, a larval parasitoid of stalk borer was also recorded from fields. The peak activity of egg-parasitoid, *T. beneficiens* was observed to be 16.20 per cent during 31st SMW and declined up to 7.15 per cent during 35th SMW. A parasitisation of larvae by *Isotima javensis* was observed from 22nd SMW (2.00%) and increases up to 12.25 per cent during 35th SMW thereafter decreases up to 6.30 per cent during 38th SMW. The

parasitisation of top borer by *Rhaconotus scirpophagae* was recorded minimum (3.15%) during 26th SMW which increased up to 9.00 per cent during 35th SMW. The parasitisation of *Stenobracon deesae* was ranged from 4.30 per cent during 31st SMW to 7.60 per cent during 38th SMW.

5. IISR, Lucknow (U.P.)

The incidence of *Pyrilla perpusilla* was very high which was suppressed in the month of October by its parasite, *Epiricania melanoleuca*. The incidence of mealy bug was cent per cent. No incidence of whitefly was observed. The population of black bug varied from 2-50/cane. The parasitisation by *Telenomus beneficiens* (44% on egg mass basis), *Stenobracon sp*. (1.5-4.0 per cent), *Rhaconotus sp*. (3.5-11%), *Isotima javensis* (3.4-4.0%) was observed. The cocoons of *Epiricania melanoleuca* on per leaf basis varied from 7-20 in the month of August and 20-80 in the month of October.

6. SRI, RAU, Pusa (Bihar)

Apantelis flavipes, Rhaconotus scirpophagae and *Stenobracon deesae* were recorded against top borer. The population of *S. deesae* varied from 2.7 to 13.7 per cent during May to October. Thereafter, a peak (13.7%) was noticed in September. The population of *Apantelis flavipes* was ranged between 3.1 to 15.9 per cent during May to November with its highest population (15.9%) was recorded in month of September. The activity of *R. scirpophagae* was recorded from July to November with its peak (7.8%) in month of September. The parasitization of *T. pyrillae* and *E. melanoleuca* were recorded from May to November and their highest parasitization per cent was recorded 42.7 per cent and per cent in the month of August and October, respectively. In case of stalk borer, the parasitization of *Apantalis flavipes* was recorded from 4.1 to 18.1 per cent.

7. G.S. Sugarcane Breeding and Research Station, Seorahi (U.P.)

The bio-agents viz. *Isotima javensis, Stenobracon sp., Elasmus zehnteri* and *Rhaconotus scirpophagae* were recorded major parasitoid of top borer 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 2.50 per cent during 22th SMW and increases up to 16.00 per cent during 35th SMW there after decreases up to 5.00 per cent during 38th SMW. The parasitisation of *Stenobracon sp.* was observed with minimum 2.85 per cent during 22nd SMW and increases up to 16.00 per cent during 35th SMW there after decreases up to 3.33 per cent during 38th SMW. The parasitisation of top borer by *Elasmus zehnteri* was observed with 4.16 per cent during 26th SMW and increases up to 13.63 per cent during 35th SMW there after decreases up to 3.33 per cent during 38th SMW. *Rhaconotus scirpophagae* was observed minimum 3.33 per cent during 26th SMW and increases up to 12.50 per cent during 35th SMW there after decreases up to 4.44 per cent during 38th SMW. *Cotesia flavipes* parasitizes maximum 13.63 per cent stalk borer larvae during 38rd SMW and also decreases up to 6.33 per cent during 47th SMW.

8. SRS, Dr. PDKV, Akola (M.S.)

Under Project E. 30, results were not reported by the concerned centre.

9. CSRS, MPKV, Padegaon (M.S.)

The parasitoid, *Encarsia flavoscutellum* ranged from 0.33 to 2.67 per leaf. The predator, *Micromus igorotus* ranged from 0.33 to 2.67 per leaf and peak was observed in 35 SMW. The mealy bug incidence ranged from 1 to 9 per cent and peak activity was noticed in 38 SMW.

10. Vasantdada Sugar Institute (VSI), Pune (M.S.)

The per cent incidence of early shoot borer noticed maximum (2.39%) in March 2015. The per cent incidence, intensity and infestation index of internode borer was noticed maximum 10 per cent, 0.56 per cent and 0.06, respectively.

11. ZARS, JNKVV, Powarkheda (M.P.)

Epiricania melanoleuca up to 6.00 per cent and *Tetrastichus pyrillae* up to 21.10 per cent also recorded. The maximum parasitism of *E. malanoleuca* (34.40%) recorded one week after (34th SMW). While, maximum egg masses/ live cocoons of *E. melanoleuca* (12.70 per leaf) and *T. pyrillae* (75% parasitism) observed at 36th SMW i.e. two weeks after the peak pyrilla infestation.

12. MSRS, NAU., Navsari (Gujarat)

The parasitism done by *Apanteles flavipes* ranged from 2.01 to 4.12 per cent. The average incidence of stalk borer was 17.09 per cent and found parasitizing it during the period of study. Among them parasitism done by *Apanteles flavipes* was 3.42 per cent. Average of root borer incidence at harvest (50th STW) was 19.55 per cent and only two parasites found to be parasitizing it during the period of study.

13. ZARS, UAS, Mandya (Karnataka)

Aphid, whitefly and pyrilla appeared in very small numbers but failed to establish and spread. *Encarsia* spp. (1-3 adults/leaf) kept the woolly aphid under control.

14. Regional Sugarcane & Jaggery Research Station (MPKV), Kolhapur (M.S.)

The results were not submitted by concern centre.

15. ICAR-SBI, Coimbatore (T.N.)

The per cent incidence of early shoot borer ranged from 1.32 to 5.82 per cent. The other pests incidence *viz.*, top borer (0.44-0.51%), internode borer (0.51-35%), root borer (47.6%), woolly aphid (1.77/leaf), mealy bug (1.79%), whitefly (0.77%), termite (traces) were reported during the present investigation. *Encarsia flavoscutellum* and *Micromus* were reported to feed on sugarcane wooly aphid.

16. RARS, ANGRAU, Anakapalle (A.P.)

The peak incidence of scale insect was observed in 44th SMW (50%). The peak incidence of *Pyrilla* was observed during 43rd SMW and maximum parasitisation of *Epiricanea* was observed during 48th SMW. The parasitisation of *T. chilonis* was ranged between 1.0-4.2 per cent on the eggs of C. *infuscatellus* and parasitisation of *Sturmiopsis inferens* on larvae of *C. infuscatellus* ranged between 0.6 and 3.80 per cent

from April to July months. The higher activity of the parasitoid, *Encarsia flavoscutellum* was observed during the month of January.

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

1. IISR, Lucknow (U.P.)

Green-lace wing, *Chrysoperla carnea* is a predatory insect as its grubs are voracious feeders and feed upon a number of soft bodied insects, eggs and newly emerged borer larvae. Laboratory rearing of this predatory insect was carried out.

Note: New scientific name of the Chrysoperla is *Chrysoperla zastrowi sillemi.* Tabular data were not submitted by the concerned centre.

2. RARS, ANGRAU, Anakapalle (A.P.)

The mass culturing of *Beauveria bassiana* on different solid media was tried and the results indicated that among the solid media, 'par boiled rice' produced highest spore count of 13 x 10^8 per ml with less biomass (0.13g/ 100gm) followed by maize (12.1 x 10^8 /ml), rice (12 x 10^8 /ml) and found as the best suitable media for mass culturing of *Beauveria bassiana*.

3. Regional Research Station, Uchani Dist- Karnal (Haryana)

Report is not submitted by concern centre.

4. Vasantdada Sugar Institute (VSI), Pune (M.S.)

Trichogramma chilonis was mass produced on *Corcyra cephalonica* with 605.90 cc (121.18 lac) eggs and 448 cards (89.60 lac parasites).

5. CSRS, MPKV, Padegaon (M.S.)

The allotted bio-agent for multiplication is *Chrysoperla carnae*. This bio-agent was tried to multiply on sugarcane woolly aphid in field. The bio-agent was released in field. However, it was developed at low level in the experimental field. This might be due to presence of other predator's *viz., Micromus igorotus* and *Encarsia flavoscutellum.*

Note: New scientific name of the Chrysoperla is *Chrysoperla zastrowi sillemi.* Tabular data were not submitted by the concerned centre.

6. ICAR-SBI, Coimbatore

The results pertaining to Project E. 34 were not submitted by concerned centre.

Project E. 36 : Management of borer complex of sugarcane through lures

1. Regional Research Station, PAU., Kapurthala (Punjab)

The activity of early shoot borer started from first week of May to last week of August. The highest numbers of early shoot borer were trapped in third week of May. Incidence of early shoot borer in treatment and control plots was 6.57 and 9.79 per cent, respectively, Thus there was reduction of 32.89 per cent by lure alone. Incidence of top borer in treatment and control plots was 7.95 and 12.16 per cent, respectively, Thus

there was reduction of 34.62 per cent in the incidence of top borer by lure. Incidence of stalk borer in treatment and control plots was 6.05 and 10.63 per cent, respectively, Thus, there was reduction of 43.08 per cent in the incidence of stalk borer.

2. Regional Research Station, Uchani Dist- Karnal (Haryana)

Report is submitted.

3. U.P. Council of Sugarcane Research, Shahjahanpur (U.P.)

An experiment was conducted with CoS 08272 cultivar at Shahjahanpur to study the management of borer complex of sugarcane (early shoot, top and stalk borer) through pheromone trap and to know the influence of weather parameters on moth catches. The investigation revealed that highest number of shoot borer (6.67 moths/trap) was recorded during 18th SMW followed by 17th SMW (5.00 moths/trap), 16th and 19th SMW (3.33 moths/trap). Top borer moth catches were recorded maximm (7.33 moths /trap) during 28th SMW followed by 19th SMW (6.33 moths/trap), 18th SMW (5.67 moths/trap) and 11th SMW (4.00 moths/trap). The highest moth catches (5.00 moths/trap) of stalk borer was observed during 37th SMW followed by 24th SMW (4.67 moths/trap) and 38th SMW (3.67 moths/trap).

The incidence was also observed in treated (application of pheromone trap). The per cent incidence of shoot borer (10.50%), top borer 2nd brood (3.50%), 3rd brood (5.15%) and at harvest (13.00%) and infestation index of stalk borer was recorded as 1.20 in treated plot. While, the corresponding parameters were 14.00, 5.00, 7.00, 16.60 per cent and 2.00 infestatioin index in untreated plots, respectively.

4. IISR, Lucknow (U.P.)

Total number of male moths of top borer (II brood) caught in traps was 337 (56.17 moths/trap), total catch of top borer moth (III brood) was 166 (27.67 moths /trap) and of IV brood was only 77 (12.83/trap). Incidence of top borer (II brood) in plot with traps ranged from 3.45-5.62 % (average 4.77%) as against 4.39-8.89 % (average 6.74%) in without traps. Incidence of top borer (III brood) in plots with traps and without traps were 5.20-16.30 per cent (Av. 11.69 %) and 7.78-23.33 per cent (Av.14.80 %), respectively. Incidence of IV brood was severe 28.62-48.57 per cent (Av.38.13 %) incidence in plot without trap was 25.00-45.00 per cent (Av. 32.89 %).

5. SRI, RAU, Pusa (Bihar)

The incidence of ESB in treated plot and untreated plots were 11.63 and 15.87 per cent, respectively. However, their incidences in treated and untreated plot were 15.71 and 18.44 per cent, respectively. The incidence of stalk borer in treated and untreated plots were 5.56 and 7.23 per cent, respectively

6. G.S. Sugarcane Breeding and Research Station, Seorahi (U.P.)

The per cent incidence was also observed in treated (application of pheromone trap) and untreated plot (without pheromone trap). The incidence of shoot borer was 5.65 per cent. Top borer in 2nd brood was 2.00 per cent, 3rd brood was 3.75 per cent and at harvest (4.15%). The infestation of stalk borer on cane basis was 5.00 per cent in

treated plot. While the corresponding parameters were 8.95, 3.76, 5.07, 7.15 and 8.45 per cent in untreated plots, respectively

Note: The concerned centre submitted the results of Project E. 36 in the format of concluded Project E. 32.

7. SRS, Dr. PDKV, Akola (M.S.)

The results of experiment were not submitted by concerned centre.

8. CSRS, MPKV, Padegaon (M.S.)

The installation of pheromone traps @ 15 per ha reduced the incidence of 57.51 and 34.07 per cent of early shoot borer and internode borer, respectively and increased 11.11 per cent sugarcane yield over untreated control.

9. Vasantdada Sugar Institute (VSI), Pune (M.S.)

Top shoot borer adults were not captured. The per cent incidence of ESB was maximum (4.09 %) in April 2015 in treated plot, while it was maximum (4.46%) in May 2015 in control plot. The per cent incidence of internode borer was noticed as maximum (4.0 %) in June 2015 and Dec 2015, while it was 16.0 per cent in July 2015 in control plot. Treated and control plots were free from top borer infestation.

10. ZARS, JNKVV, Powarkheda (M.P.)

The cumulative ESB infestation in the control block remained 26.60 per cent, while it was 16.60 per cent in lure managed block i.e., 25.22 per cent lower as compared to control block.

11. RSRS, NAU., Navsari (Gujarat)

The maximum (4.00) moths of early shoot borer were caught in 31th SMW.

12. ZARS, UAS, Mandya (Karnataka)

The cumulative ESB incidence in the control block remained at 4.05 per cent while it was 3.47 per cent in the lure managed block. Top shoot borer incidence was 2.84 per cent in lure managed block and it remained at 2.20 per cent in the control block. The incidence of internode borer was 27.25 per cent in lure managed block. Whereas, it was 29.75 per cent in the control block. The peak activity of ESB (2.5moths/trap/week), TSB (6.55moths/trap/week) and INB (1.755moths/trap/week) was observed during 22nd, 30th and 11th SMW, respectively.

13. RARS, ANGRAU, Anakapalle (A.P.)

The early shoot borer moth catch was the highest during 17th SMW (122 moths/ 5 traps / week), whereas internode borer moth catches were highest during 24th SMW (119 moths/ 5 traps/week).

Project E. 37 : Bio-efficacy of new insecticides for the control of sugarcane early shoot borer.

1. Regional Research Station, PAU., Kapurthala (Punjab)

The efficacy of different insecticidal treatments tested against sugarcane early shoot borer revealed that cumulative per cent incidence of early shoot borer observed at

30, 60, 90 and 120 days after planting was least for the treatment of Chlorantraniliprole 18.5 SC @ 375 ml/ha, thereby resulting in increased economic parameters like cane yield, total cane height, sucrose (% in juice) and CCS(%).

2. U.P. Council of Sugarcane Research, Shahajahanpur (U.P.)

Spraying of chlorantraniliprole 18.5 SC @ 375 ml/ha at 30 and 60 DAP recorded least cumulative incidence of ESP (4.43%) followed by soil application of chlorantraniliprole 0.4G @ 22.5 kg/ha at the time of planting and 60 DAP (4.81%) as compared to untreated control (8.61%). The cane girth was highest (2.61cm/cane) in spraying of flubendiamide @ 125 ml/ha at 30 and 60 DAP followed by soil application of carbofuran 3G @ 33 kg/ha (2.48 cm/cane). Whereas, the cane height was maximum with spraying of chlorantraniliprole 18.5SC @ 375 ml/ha at 30 and 60 DAP (2.18 mt/ha) followed by spraying of flubendiamide 45SC @ 250 ml/ha at 30 and 60 DAP (2.05 mt/cane) and soil application of fipronil 0.3 G @ 25 kg/ha at the time of planting and 60 DAP (2.01 mt/cane). The maximum cane yield (105t/ha) was recorded by spraying of chlorantraniliprole 18.5 SC @ 90 ml.

3. SRI, RAU, Pusa (Bihar)

The treatment of chlorantraniliprol 18.5 SC @ 375ml/ha was superior when it was sprayed at 30 DAP and 60 DAP as the recorded maximum germination (33.7 %), least cumulative incidence of ESB (5.28%) and highest cane yield (85.8 t/ha).

4. CSRS, MPKV, Padegaon (M.S.)

The bio-efficacy of newer insecticides for the management of sugarcane early shoot borer revealed that the treatment with soil application of chlorantraniliprole 0.4 G @ 22.5 kg / ha at the time of planting and 60 DAP was found most effective against early shoot borer on sugarcane with least cumulative incidence of early shoot borer (18.36 per cent) and recorded highest cane yield (128.89 t/ha) over rest of the treatments.

5. Vasantdada Sugar Institute (VSI), Pune (M.S.)

The treatment of soil application of chlorantranilliprole 0.4 G @ 22.5 kg/ha at the time of planting and 60 DAP or spraying of chlorantraniliprole 18.5 SC @ 375 ml/ha at 30 and 60 DAP or soil application of fipronil 0.3 G @25 kg/ha at the time of planting and 60 DAP or spraying of spinosad 45% SC @ 90ml/ha at 30 and 60 DAP were found effective for the management of early shoot borer.

6. ZARS, JNKVV, Powarkheda (M.P.)

The treatment of chlorantraniliprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP (SA) and chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP (S) found to reduce the natural infestation of ESB effectively (82.11 and 80.74%, respectively) with increased cane yield by 21.89 and 19.61 per cent, respectively.

7. MSRS, NAU., Navsari (Gujarat)

Soil application of chlorantraniliprole 0.4 G @ 22.5 kg/ha at the time of planting and 60 DAP recorded the minimum cumulative per cent incidence (13.82%) with highest millable cane yield (125.49 t/ha).

8. ZARS, UAS, Mandya (Karnataka)

Soil application of chlorantraniliprole 0.4G @ 22.5kg/ha at the time of planting and 60 DAP, spray application of chlorantraniliprole 18.5SC @ 375ml/ha and flubendiamide 39.35 SC at 30 and 60 DAP were found effective in management of early shoot borer.

9. RARS, ANGRAU, Anakapalle (A.P.)

Soil application of chlorantraniliprole 0.4G @ 22.5kg/ha (2.31%DH), fipronil 0.3G @ 25kg/ha (5.40 %DH) at planting and 60 days after planting (DAP) significantly reduced the incidence of early shoot borer compared to untreated control (30.66%). The highest cane yield was recorded in chlorantraniliprole 0.4G @ 22.5kg/ha (86.46 t/ha) as compared to untreated control (75.65t/ha).

Salient achievements of Entomology

- There was significantly reduction of incidence of ESB, TB and SB (43.08%) in lure treated plot in North western zone while no significant difference in top borer incidence was recorded in plots with and without sex pheromone traps at Lucknow.
- The cumulative incidence of early shoot borer was significantly reduced in application of Chlorantraniliprole 18.5 SC @ 375 ml/ha increased cane yield, total cane height, sucrose (% in juice) and CCS (%) in North Western Zone.However, soil application of chlorantraniliprole 0.4 G @ 22.5 kg / ha was significantly reduced incidence of early shoot borer with higher yield in Peninsular zone.
- The mass multiplication of *Beauveria bassiana* was done on different solid media. It was found that the solid media, par boiled rice produced highest spore count of 13 x 10^8 per ml with less biomass (0.13g/ 100gm) followed by maize (12.1 x 10^8 /ml), rice (12 x 10^8 /ml) and found as the best suitable media. The predator green-lace wing, ***Chrysoperla zastrowi sillemi*** was mass multiplied in the laboratory on laboratory host, *Corcyra cephalonica*.
- The high incidence of whitefly, web mite, root borer and Pyrilla was reported in different varieties in North Western Zone where as severe incidence of Early shoot borer and Internode borer was observed in Peninsular zone.
- It was observed that a minor insect, pink borer damaged the crop like shoot borer, top borer and stalk borer right from the shoot stage till harvest. Black bug was reported a pre-monsoon pest of sugarcane ratoon crop but its severe incidence was observed in the plant crop during post monsoon period July to October at Karnal region.
- The egg parasitoids, *Trichogramma chilonis*;larval parasitoiods *Stenobracon nicevillae, Rhaconotus* scirpophagae, *Isotima javensis, Sturmiopsis inference*,*Cotesia flavipes* and nymphal and adult parasitoid,*Fulgoraecia melanoleuca* were observed in different zones.

PERFORMANCE OF CENTRES IN CONDUCTING AICRP TRIALS
(2015 - 2016)

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, 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 69	AS 68, AS 70, AS 71, AS 72
		Plant Pathology	PP 17 (D), PP 31	Nil	All
		Entomology	E 4.1, E 28, E 30, E 33, E 36,	E 4.1, E 28, E 30	E 36
2.	Basmathnagar	Plant Breeding	IVT (E), AVT (E)-I, IVT (M)	All	Nil
3.	Coimbatore	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 72	AS 69, AS 70, AS 71
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 22, PP 23, PP 33	All	Nil
		Entomology	E 4.1, E 28, E 30, E 34	All	Nil
4.	Kolhapur	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 72	AS 68, AS 69, AS 70, AS 71
		Plant Pathology	PP 17B, PP 17D, PP 22, PP 28B, PP 31, PP 32	All	Nil
		Entomology	E 4.1, E 28, E 30	All	Nil

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
5.	Mandya	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	All	Nil
		Entomology	E 4.1, E 28, E 30, E 36, E 37	All	Nil
6.	Navsari	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	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 36, E 37	All	Nil
7.	Padegaon	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	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 37	All	Nil
8.	Perumalapalle	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
9.	Powarkheda	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 69, AS 70, AS 71, AS 72	AS 68
		Plant Pathology	PP 17A, PP 17B, PP 17C, PP 22	All	Nil
		Entomology	E 4.1, E 28, E 30, E 36, E 37	All	Nil

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
10.	Pravaranagar	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
11.	Pugalur	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
12.	Pune	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 72	AS 70, AS 71
		Plant Pathology	PP 17B, PP 17D, PP 22, PP 28(b), PP 31, PP 32, PP 33	PP 17B, PP 17D, PP 22, PP 31, PP 32, PP 33	PP 28(b)
		Entomology	E 4.1, E 28, E 30, E 34, E 36, E 37	All	Nil
13.	Rudrur	Plant Breeding	IVT (E), AVT (E)-I P, IVT (M)	IVT (E), IVT (M)	AVT (E)-I P
14.	Raipur (Kawardha)	Plant Breeding	IVT (E), IVT (M), AVT (M)- R	All	Nil
15.	Sameerwadi	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
16.	Sankeshwar	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	All	Nil
		Plant Pathology	PP 17B, PP 17D, PP 22, PP 28(b), PP 31, PP 32, PP 33	All	Nil

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
17.	Thiruvalla	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	All	Nil
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 22	All	Nil
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	All	Nil
		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	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 31, PP 33	PP 23, PP 28(b)
		Entomology	E 4.1, E 28, E 30, E 34, E 36, E 37	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)	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 17D, PP 22, PP 23, PP 30	PP 14, PP 14A, PP 17A, PP 17B, PP 22, PP 23, PP 30	PP 17D

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
3.	Nayagarh	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, AVT (M)-I P, IVT (M)	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 17D, PP 22	PP 14, PP 17B, PP 17C, PP 23, PP 31
4.	Nellikuppam	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (M)-I P, AVT (E)-R, IVT (M)	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)	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)-I P, AVT (M)-II P, AVT (M)-R	All	Nil
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	AS 69	AS 68, AS 70, AS 71, AS 72
		Plant Pathology	PP 17D	Nil	All
2.	Gorakhpur	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
3.	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)-R, IVT (M), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	AVT (E)-II P
		Plant Pathology	PP 17A, PP 17B, PP 17D	All	Nil

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
4.	Pusa	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	All	Nil
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23, PP 31	All	Nil
		Entomology	E 4.1, E 28, E 30, E 36, E 37	All	Nil
5.	Seorahi	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 72	AS 69, AS 71
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 22, PP 23, PP 31	All	Nil
		Entomology	E 4.1, E 28, E 30, E 36, E 37	All	Nil
North Eastern Zone					
6.	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	All	Nil
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	All	Nil
		Plant Pathology	PP 17A, PP 17D, 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 67, AS 68, AS 70, AS 71, AS 72, AS 73	All	Nil
2.	Karnal (SBI)	Plant Breeding	IVT (E), AVT (M)-I P, AVT (M)-II P, AVT (M)-R	All	Nil
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17D, PP 22, PP 23, PP 31	All	Nil
		Entomology	E 4.1, E 28, E 30	All	Nil

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
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	IVT (E), AVT (E)-I P, AVT (E)-II P, IVT (M), AVT (M)-I P, AVT (M)-II P	AVT (E)-R, AVT (M)-R
		Agronomy	AS 68, AS 69, AS 70, AS 71, AS 72	All	Nil
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 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 33	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22	PP 33
		Entomology	E 4.1, E 28, E 30, E 34, E 36	All	Nil
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 17D, PP 22, PP 23, PP 31	All	Nil
		Entomology	E 4.1, E 28, E 30, E 36, E 37	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	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
		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

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
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 72(E), AS 72(M)	All	Nil
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 22, PP 23, PP 31	All	Nil
		Entomology	E 4.1, E 28, E 30, E 36, E 37	All	Nil
9.	Sriganganagar	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	All	Nil
10.	Uchani	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E)-II P, AVT (E)-R, IVT (M)	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, PP 17D, PP 22, PP 23, PP 31, PP 33	PP 14, PP14A, PP 17A, PP 17D, PP 22, PP 23, PP 31	PP 33
		Entomology	E 4.1, E 28, E 30, E 36	All	Nil

All India Coordinated Research Project on Sugarcane

Constitution of Monitoring Team for 2016-2017 Crop Season

1. NORTH WEST ZONE

i)	Dr. R.K. Sahu, GBPUAT, Pantnagar	-	Team Leader
ii)	Dr. S.K. Ghoshal, SRS, Bethuadahari	-	Member
iii)	Prof. S.N. Gajjar, MSRS, Navsari	-	Member
iv)	Dr. Ravinder Kumar, ICAR-SBI RC, Karnal	-	Member

2. NORTH CENTRAL & NORTH EASTERN ZONE

i)	Dr. T.E. Nagaraja, ZARS, Mandya	-	Team Leader
ii)	Dr. C. Gupta, ICAR-IISR, Lucknow	-	Member
iii)	Dr. M.L. Chhabra, ICAR-SBI RC, Karnal	-	Member
iv)	Dr. M.P. Badgujar, CSRS, Padegaon	-	Member

3. PENINSULAR ZONE I

i)	Dr. R. Karuppaiyan, ICAR-SBI, Coimbatore	-	Team Leader
ii)	Dr. Kuldeep Singh, PAU RS, Faridkot	-	Member
iii)	Dr. B.H. Pawar, VSI, Pune	-	Member
iv)	Dr. A.K. Baitha, ICAR-IISR, Lucknow	-	Member

4. PENINSULAR ZONE II

i)	Dr. P.K. Nayak, SRS, Nayagarh	-	Team Leader
ii)	Dr. Rajinder Kumar, PAU RRS, Kapurthala	-	Member
iii)	Dr. S.K. Thakur, SRI, Pusa	-	Member
iv)	Dr. N. Raja Kumar, RARS, Anakapalle	-	Member

5. EAST COAST ZONE

i)	Dr. S.B. Patil, ARS, Sankeshwar	-	Team Leader
ii)	Dr. R.K. Mehra, RRS, Uchani	-	Member
iii)	Dr. A.K. Singh, ICAR-IISR, Lucknow	-	Member
iv)	Dr. K.P. Pandey, UPCSR, Shahjahanpur	-	Member

Visit Schedule of the Monitoring Teams during 2016-17 crop season

Name of the zone	Date of visit	Centres visited
North West Zone	07.09.2016 to 18.09.2016	Lucknow, Shahjahanpur, Muzaffarnagar, Pantnagar, Karnal, Uchani, Kapurthala, Faridkot, Sriganganagar and Kota
North Central & North East Zone	31.08.2016 to 01.09.2016	Gorakhpur, Seorahi, Pusa, Motipur, Muzaffarpur, Bethuadahari and Buralikson
Peninsular Zone-I	30.08.2016 to 07.09.2016	Coimbatore, Pugalur, Thiruvalla, Mandya Sankeshwar, Sameerwadi, Kolhapur and Perumalapalle
Peninsular Zone-II	14.09.2016 to 25.09.2016	Pune, Pravaranagar, Padegaon, Akola, Powarkheda, Navsari and Rudrur
East Coast Zone	24.09.2016 to 04.10.2016	Nellikuppam, Cuddalore, Vuyyuru, Anakapalle and Nayagarh

Action Taken Report on the recommendations of the Group Meeting of AICRP on Sugarcane held at the Sugarcane Research Institute (RAU), Pusa, Distt. Samastipur (Bihar) on 15-16 December, 2015

S. No.	Recommendation	Action Taken
1.	The data of AICRP trials should be submitted on proper format by the scientists. Possibility may be explored for development of software for on-line submission of data. **(Action : PC (Sugarcane)**	Presently the data in Excel sheet are being submitted by the different centres. A project for development of software for online submission of the data by all the centres has been taken up at IISR, Lucknow in leadership of Dr. S.S. Hasan, Principal Scientist, Computer Science at IISR, Lucknow.
2.	Fast multiplication of seed of new varieties may be taken up at the AICRP centres. **(Action : Incharges, AICRP centres)**	Being taken up.
3.	Drip irrigation may be promoted for efficient water-use efficiency. **(Action : Incharges, AICRP centres)**	Experiments have been conducted at 3 centres of two zones viz., Faridkot & Lucknow (North West Zone) and Cuddalore (Peninsular Zone).
4.	In view of change in climate, varieties may be developed to such changes. **(Action : Breeders of AICRP centres)**	Evaluation and identification of climate resilient ISH and IGH genetic stocks are going on at Padegaon, Anakapalle, Faridkot and Karnal (SBI) centre.
5.	A new research programme may be initiated for managing yellow leaf disease which is becoming wide-spread in the country. **(Action : PC (Sugarcane); P.I., Plant Pathology)**	An experiment has been initiated at various centres Lucknow, Uchani, Pantnagar, Coimbatore, Pune, Sankeshwar & Anakapalle on management of Yellow leaf disease (YLD) through meri-stem autumn.