



अखिल भारतीय समन्वित गन्ना अनुसंधान परियोजना
All India Coordinated Research Project on Sugarcane

Annual Report 2020-21

Dr. A.D. Pathak
Director &
Project Coordinator



भाकृअनुप-भारतीय गन्ना अनुसंधान संस्थान, लखनऊ-226 002
ICAR-INDIAN INSTITUTE OF SUGARCANE RESEARCH, LUCKNOW – 226 002



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PREFACE



Sugar industry is the second largest agro-based industry in India which contributes significantly to the socio economic development of the nation. The Indian sugar industry is also a major sector to create employment including sugarcane growers, semi-skilled and skilled personnel engaged in its processing in sugar mills and allied industries across the nation. At present, sugarcane is the only raw material supplied to the mills for sugar production. In non-sugar mill areas, sugarcane is processed for jaggery and khandasari manufacturing to fulfill the domestic consumption of sweeteners and value addition.

The country has become a net surplus producer of sugar. According to an statement of ISMA, India's production of sugar rose by 13 per cent to 305.68 lakh tonnes in the first eight months of the current marketing year ending September, 2021. This could be attributed mainly to increased area under high yielding and high sugar varieties suitable for different growing conditions along with improved production and protection technologies. Adoption of location specific and high yielding high sugar varieties coupled with improved production and protection technologies has resulted into increased yield (79.42 t/ha) and production (397.7 mt) of sugarcane (2020-21). The main reason has been the adoption of improved sugarcane varieties, trench method of planting, ratoon management practices and water saving techniques. An integrated approach including improved soil health, crop protection measures and climate resilient varietal development efforts are needed to be looked afresh for all possible improvements.

In order to address the various issues in different sugarcane growing zones, the technical programme for Crop Improvement, Crop Production and Crop Protection disciplines assume great importance to cope up the demand of raising productivity level with higher sugar recovery. To develop location specific high yielding sugarcane varieties with high sugar, zonal varietal trials of early and mid-late maturing varieties were conducted to screen the promising genotypes. In view of developing abiotic stress tolerant varieties, ISH & IGH programmes are being executed at certain centers for both drought as well as water-logging conditions. Crop Improvement Programme of All India Co-ordinated Research Project on Sugarcane (AICRP-S) is the major contributor for the development and release of improved varieties under National Sugarcane Varietal Development Programme. During the year 2020-21, seven sugarcane varieties viz. VSI 12121, Co 13013 (Akshaya), MS 13081 (Phule 10001), Co 15023 (Karan-15), CoLk 14204 (Ikshu-8), CoPb 14185 (CoPb 98) and CoSe 11453 have been identified in Varietal Identification Committee meeting held on 19th October, 2020 during 33rd Biennial Workshop of AICRP on Sugarcane. Out of these, 03 sugarcane varieties such as VSI 12121, Co 13013 (Akshaya) for Peninsular Zone and Co 15023 (Karan-15) for north west zone have been released & notified by Central Varietal Release Committee (CVRC) for commercial cultivation in respective sugarcane growing zones.

The twin objectives of Crop Improvement programmes under 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. 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. A total of 26 Zonal Varietal Trials (12 in early, 10 in mid-late and 4 by combining both early and mid-late entries) were conducted during the year 2020-21. There were 6 IVT and 20 AVT trials. A total of 47 entries in early group, 49 entries in mid-late group and 45 entries by combining both early and mid-late groups were evaluated of which 14 in early, 9 in mid-late and 6 combining both early and mid-late groups were promising. Details of the trials conducted, number of entries evaluated and the promising clones identified have been given in the Principal Investigator's report. In crop production, elite genotypes belonging to early and mid-late groups were found to perform better at wider spacing of 120 cm in subtropical region and at 150 cm in peninsular and east coast zones. The response to higher (125%) recommended dose of fertilisers was conspicuous across the zones. Studies on long term weather data indicated continuous reduction in rainfall in the north-west zone combined with marginal rise in minimum temperature. Water efficient sugarcane varieties were identified for different zones.

The crop protection encompasses entomology and plant pathology. During the year 2020-21, six experiments were conducted in entomology discipline at 11 centres under four sugarcane growing zones. In North West Zone, CoLk 14201, Co 15023, Co 15024, Co 15027, Co 15027 in early group and Co 15026 in mid late group were found to be either less susceptible (LS) or moderately susceptible (MS) against all the major insect-pests. In North Central Zone, all the genotypes screened were either LS or MS against ESB, top borer, stalk borer and root borer. In Peninsular Zone, all the entries were HS for one or more than one insect-pests except MS 17082 in IVT trial, which was either LS or MS against all the major insect-pests at all the centres. In East Coast Zone, all the entries were HS for one or more than one insect-pests except CoC 16337 in early group and CoC 16338 & CoV 92102 in mid-late group which were either LS or MS against all the major insect-pests.

Under project on survey and surveillance of sugarcane insect-pests, severe to low incidence of sugarcane insect-pests viz., ESB, root borer, internode borer, stalk borer, top borer, plassey borer, fall army worm, white grub, termites, scale insect, white fly, mealy bug, web mite, sugarcane woolly aphid, rusty plum aphid, thrips, black bug were reported from different parts of the country. Some uncommon insect-pests viz., plant hopper (*Eoerysa flavocapitata*), blister mite were also reported. Invasive insect-pest, Fall army worm (*Spodoptera frugiperda*) was reported this year also on sugarcane from Andhra Pradesh. A new invasive pest, Rugose Spiralling Whitefly (RSW), *Aleurodicus rugioperculatus* (Hemiptera: Aleyrodidae), which had invaded India in 2016, has been recorded on sugarcane for the first time at RARS, Anakapalle. Its incidence is recorded to the tune of 5-20 percent. Along with RSW, natural enemies viz., lady bird beetles, *Cryptolaemus montrouzieri*, *Chilocorus nigrita*, *Scymnus nubilus* and the parasitoid wasp, *Encarsia guadelopae* were recorded in sugarcane ecosystem.

Besides, a plant sucking bug, *Phaenacantha bicolor* (Dist.) (Hemiptera: Colobathristidae) was recorded as pest of sugarcane at Thiruvalla, Kerala. This is reported from the Indian Subcontinent for the first time. Mass multiplication of sugarcane bio-agents using cost effective techniques was done for *Trichogramma chilonis*, *T. pretiosum*, *Eumicrosoma* sp., *Beauveria brongniartii*, *B. bassiana* and *Metarhizium anisopliae* and *Cladosporium cladosporioides* for use against various insect-pests. Assessment of yield losses caused by borer pests revealed significant yield loss of sugarcane crop raised without protection measures.

In Plant Pathology, eight experiments viz. Identification of pathotype in red rot pathogen, Evaluation of zonal varieties for Red rot, Smut, Wilt, YLD, Rust and Pokkahboeng, Survey of sugarcane diseases naturally occurring in the area on important varieties, Assessment of elite and ISH genotypes for resistance to red rot, Screening, epidemiology and management of pokkah boeng (PB) in sugarcane, Management of brown spot disease of sugarcane, Management of yellow leaf through meristem culture and Efficient delivery of fungicides and other agro inputs to manage major fungal diseases in sugarcane were conducted by the assigned centers. Studies on epidemiology and its management in six centers showed that PB incidence was highly correlated with rainfall, temperature and RH. Experimental results indicated that sett treatment with Carbendazim + foliar spray with Carbendazim @ 0.1% at 15 days interval was found effective for better germination and PB management. Studies on management of brown spot disease of sugarcane showed that 3 sprays of fungicides Tebuconazole and Propiconazole @ 0.1% at 15 days interval after initiation of disease were found effective to control brown spot.

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 centres-ICAR-Indian Institute of Sugarcane Research, Lucknow and ICAR-Sugarcane Breeding Institute, Coimbatore.

The salient research achievements of 2020-21 in disciplines of Crop Improvement, Crop Production, Plant Pathology and Entomology disciplines have been presented in this report.



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ACKNOWLEDGEMENTS

The experiments on different aspects of sugarcane have been conducted at various centers as per the approved technical programme. A Group Meeting of AICRP on Sugarcane at the National level is organised to review the annual progress and to finalise future course of action. We wish to express our deep sense of gratitude to Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR for his kind approval to organize the Group Meeting of AICRP on Sugarcane at the ICAR-Indian Institute of Sugarcane Research, Lucknow during October 21 - 22, 2021 through hybrid (physical & virtual) mode.

We are highly grateful to Dr T.R. Sharma, Deputy Director General (CS) and Dr. R.K. Singh, Asstt. Director General (Commercial Crops), ICAR for their valuable guidance and encouragement in effective execution of the research programme of the AICRP on Sugarcane, timely review of the outcome and granting Council's approval for the Workshop.

We wish to thank to all the Principal Investigators, namely Dr. Bakshi Ram, Ex-Director, ICAR-SBI, Coimbatore, Dr G Hemaprabha, Director (acting) and PI Crop Improvement, Dr. T.K. Srivastava, Principal Scientist and PI Crop Production, Dr. R. Viswanathan, HOD Crop Protection and PI Plant Pathology ICAR-SBI, Coimbatore and Dr. S N Sushil, Principal Scientist and PI Entomology, ICAR-IISR, Lucknow for their cooperation in framing the technical programmes and painstaking task of preparing technical reports for the year 2020-21.

Efforts made by the Station In-charges, scientists and staff members associated with the AICRP on Sugarcane at the regular as well as voluntary centres in conducting various trials, submission of data and reports are gratefully acknowledged.

The painstaking efforts made by our colleagues namely Dr. S.K. Shukla, Head, Division of Crop Production, Dr Rajesh Kumar, Principal Scientist & Incharge, AKMU, Dr S.S. Hasan, Principal Scientist, AKMU, Dr. Lalan Sharma, Scientist (Plant Pathology) and Dr. S.K. Yadav, Scientist (Agronomy), Dr. G.K. Singh, Shri Adil Zubair Chief Technical Officers in compilation of the Coordinator's Report 2020-21 and preparations for Group Meeting of AICRP on Sugarcane are appreciated and thankfully acknowledged. Help rendered by Shri Aravind Kumar Yadav, UDC and Shri Ambrish Kumar Sahu, Young Professional-I in computer work is also duly acknowledged.



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About The All India Coordinated Research Project On Sugarcane

All India Coordinated Research Project on Sugarcane is serving to the Nation by coordinating research work since 1970 through a network of sugarcane research stations of ICAR, State Agricultural Universities, State Govt. Departments and Non-Government Organizations. At present, there are 22 regular centres and 17 voluntary centres for conducting research and multi-location testing of varieties/technologies for wider adoption. The Project also provides forum to the researchers for deliberations on new varieties and making recommendations on crop production and protection technologies. In order to provide fluff to the breeders, a National Hybridization Garden was established in 1972 at the ICAR-Sugarcane Breeding Institute, Coimbatore wherein all the parents so far identified for their specific characters are planted in separate plots and the breeders of the centers make use of these for crossing and fluff production. SBI, Coimbatore also extends facility for crossing work at the National Distant Hybridization Facility established at Agali (District Palakkad, Kerala). The research programmes of the project are decided according to the mandate and objectives of the AICRP (S).

Mandate

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

Objectives

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

As per the mandate, main emphasis is laid on the development of improved sugarcane varieties suitable for commercial cultivation under different agro-climatic conditions in the country. Under this programme, 131

sugarcane varieties have been developed. The improved sugarcane varieties are meant for higher cane yield, sugar recovery and resistance against major insect-pest and diseases.

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

For the conduct of zonal varietal trials, following five zones have been identified in the country. At present 22 regular and 17 voluntary centers located at different zones are working under this project.

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

A. North West Zone

1. PAU Regional Research Station, Gurdaspur-143 521 (Punjab) (Recently shifted from Faridkot)
2. PAU Regional Research Station, Kapurthala – 144 601(Punjab)
3. U.P. Council of Sugarcane Research, Shahjahanpur – 242 001
4. G.B. Pant University of Agriculture & Technology, Pantnagar – 263 145, Distt. U.S. Nagar
5. Agricultural Research Station (SKRAU), Sriganganagar – 335 001 (Rajasthan)
6. Agricultural Research Station (AU), Ummedganj, P.B. No. 7, GPO – Nayapura, Kaithoon Road, Kota – 324 001 (Rajasthan)
7. ICAR-Indian Institute of Sugarcane Research, Rae Bareli Road, Lucknow – 226 002
8. Regional Research Station, (CCSHAU), Uchani – 132 001, Karnal (Haryana)

B. North Central Zone

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



C. North Eastern Zone

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

D. Peninsular Zone

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

E. East Coast Zone

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

Future thrust

To develop suitable varieties for biotic (disease & insect-

pests) and abiotic (water logging & drought, etc.) conditions.

There is an urgent need to evaluate more germplasm under different agro-ecological conditions for introgression genes contributing resistance to diseases and insect-pests, abiotic stresses and physiological efficiency of the genotype.

Since most of the sugarcane varieties developed so far are suited to a particular agro-climatic zone, there is a need to evolve varieties having high productivity, photo insensitivity and resistance to pests and diseases using conventional breeding methods as well as biotechnological tools. Physiological traits like relative water content, membrane injury and Na/K ratio can help in estimating tolerance to moisture stress, high temperature or salinity.

In view of global competition for sugar and its lower price in the international market, there is a need to developing low cost agro-technologies and cost of sugarcane accounts for over 65 per cent of the total cost of production of sugar in mills.

The water, being the precious commodity, there is a need to economize on its use by conducting multi-location trials with micro-irrigation systems viz., drip/sub-surface drip irrigation including fertigation.

The sudden outbreak of pests and diseases in sugarcane crop like may become economically important and could cause big economic losses at national level, if not managed in time. Recently, a few minor diseases like rust, pokkah boeng and yellow leaf disease and insect-pests like white grub and mealy bug are becoming economically important in sugarcane cultivation. Suitable protection technologies and their management will be taken up. The use of hazardous chemicals is causing environmental pollution. Thus, it is necessary to develop a bio-intensive pest and disease management system in sugarcane.

Staff Position (Since 1st April, 2018)

Sanctioned Strength	Sanctioned		Total (2+3)	No. of Posts Vacant		Total (5+6)
	At headquarters Lucknow	At AICRP(S) centres		At headquarters Lucknow	At AICRP(S) centres	
1	2	3	4	5	6	7
Scientific	04	44	48	-	-	-
Technical	04	44	48	01	-	01
Administrative	03	-	03	02	-	02
Total	11	88	99	03	-	03



CROP IMPROVEMENT

The development of location specific high yielding and high sugar varieties under AICRP on Sugarcane and their large scale adoption has revamped the sugar industry in India and has geared itself to address new challenges in future as well. In addition to the sustained sugarcane supply to fulfil the domestic needs of sugar, the provision of ethanol blending as green energy has aggravated the demand of raw material as sugarcane. The issue of climate change has to be dealt by developing climate resilient sugarcane varieties. Crop Improvement Programme of All India Co-ordinated Research Project on Sugarcane (AICRP-S) is the major contributor for the development and release of improved varieties under National Sugarcane Varietal Development Programme. In this context, during the year 2020-21 seven sugarcane varieties viz., VSI 12121, Co 13013 (Akshaya), MS 13081 (Phule 10001), Co 15023 (Karan-15), CoLk 14204 (Ikshu-8), CoPb 14185 (CoPb 98) and CoSe 11453 were developed under AICRP(S) were identified by Varietal Identification Committee meeting held on 19th October, 2020. Of these, three varieties viz., Co 13013 (Mid-late) and VSI 12121 (Mid-late) for Peninsular zone and Co 15023 (Early) for North West Zone were notified by CVRC for commercial cultivation. Rest of four varieties are under process to submit the proposal to the CVRC.

The twin objectives of Crop Improvement programmes under AICRP(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 programmes. 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 major activities under the crop improvement programmes of AICRP(S) during 2020-21 are summarized below.

Weather, pests and diseases situation:

Normal rainfall during the year 2020-21 was experienced in many centers. The highest rainfall was reported by the Thiruvalla (2828.6 mm) in Peninsular Zone followed by Buralikson (1639.5 mm) in North East Zone. Coimbatore in Peninsular zone reported the lowest rainfall of 543.8 mm followed by Gurdaspur (640.4 mm) in North West Zone. The highest maximum temperature (44.3oC) was recorded during May 2020 at Rudrur in Peninsular Zone while the lowest minimum temperature of 6.2oC was recorded during January 2021 at Gurdaspur. Minor incidence of insect-pests like early shoot borer, top shoot borer, internode borer, leaf hoppers, woolly aphid, white grubs, woolly, pyrilla, mealybug, scale insect, whitefly and sugarcane woolly aphid and diseases like leaf spot, rust, yellow leaf disease, grassy shoot, pokkah boeng, mosaic, brown spot and smut were reported by the different centers. Pusa centre reported the incidence of root borer, shoot borer, top borer, stalk borer, plassey borer, pyrilla, black bug, mealy bug, stem borer, smut, pokkahboeng, wilt, red rot, yellow leaf disease and mosaic.

Table 1.1: AICRP(S) centres participating of in fluff supply and ZVT programmes

Zone	No. of centres	Participating centres	
		Fluff receiving and ZVTcentres	ZVT – centres alone
Peninsular Zone	18	Rudrur, Perumalalpal, Navasari, Mandya, Sankeshwar, Padegaon, Pune, Powarkheda, Thiruvalla	Sameerwadi, Akola, Pravaranagar, Kolhapur, Basmathnagar, Pugalur, Coimbatore, Raipur, Belagavi
East Coast Zone	5	Anakapalle, Vuyyuru, Cuddalore, Nayagarh	Nellikuppam
North West Zone	10	Gurdaspur, Lucknow, Shahjahanpur, Pantnagar, Uchani, Kapurthala	Muzaffarnagar, Karnal, Kota, Sriganaganagar
North Central Zone	4	Motipur, Pusa, Seorahi, Bethuadahari	-
North Eastern Zone	1	Buralikson	-
Total	38	24	14



Trials conducted and the number of entries evaluated:

A total of 26 Zonal Varietal Trials (12 in early, 10 in mid-late and 4 by combining both early and midlate entries) were conducted during the year 2020-21. There were 6 IVT and 20 AVT trials. A total of 47 entries in early group, 49 entries

in midlate group and 45 entries by combining both early and midlate groups were evaluated, of which 14 in early, 9 in midlate and 6 combining both early and midlate groups were promising. Details of the trials conducted, number of entries evaluated and the promising clones identified are given below.

Table 1.2: Trials conducted and the number of entries evaluated

Zone / Trials	No. of clones + standards		Promising clones	
	Early	Midlate	Early	Mid-late
Peninsular Zone				
AVT II Plant	15+3		MS 14082	
AVT Ratoon	15+3		MS 14082	
Pooled analysis	15+3		MS 14082	
AVT I Plant	12+3		Co 11015, Co 14005, Co 15017	
IVT	18+3		-	
Total entries	45		4	
East Coast Zone				
AVT II Plant	4+3	5+3	CoA 16321, CoC 16337, CoV 16356	-
AVT Ratoon	4+3	5+3	CoA 16321, CoC 16337	CoV 16357
Pooled analysis	4+3	5+3	CoA 16321, CoV 16356	CoV 16357
AVT I Plant	3+3		-	-
IVT	3+3		CoV 18356, CoV 18357	-
Total entries	10	5	5	1
North West Zone				
AVT II Plant	6+3	7+3	Co 15027, Co 15023	CoS 15232, CoLk 15206, CoLk 15207
AVT Ratoon	6+3	7+3	-	CoLk 15206, CoLk 15207
Pooled Analysis	6+3	7+3	Co 15027	CoS 15232, CoLk 15206, CoLk 15207
AVT I Plant	6+3	5+3	-	CoS 16233
IVT	7+3	15+3	-	Co 17018, CoS 17233, CoS 17235
Total entries	19	27	2	7
North Central & North East Zone				
AVT II Plant	5+3	7+3	CoP 15436, CoLk 15466	-
AVT Ratoon	5+3	7+3	CoP 15436, CoLk 15466, CoLk 15467	-
Pooled Analysis	5+3	7+3	CoLk 15466	-
AVT I Plant	5+3	4+3	CoP 16437, CoLk 16466	-
IVT	8+3	6+3	CoP 17437, CoP 17438	-
Total Entries	18	17	7	
Grand total (Entries)	47	49	14	8
	45		4	

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



Fluff Supply Programme:

NHG 2020-21 was established with 424 parents including nine new parents viz., BO 128, CoP 9301, CoP 18436, CoP 18437 from Pusa, CoV 18357 and CoV 18358 from Vuyyuru LG 11440, LG 14482 and LG 14564 from Lucknow and two poly-cross nurseries for tropical and subtropical region were planted and maintained in pest and disease free condition. Out of 424 parents, 411 flowered with the flowering intensity of 96.93 %. Since the COVID-

19 pandemic had restricted travel during 2020, ICAR-SBI had taken up the responsibility of making the crosses for the entire country. The centers were asked to send the list of crosses of their choice based on the flowering data hosted and updated daily in ICAR-SBI website. Hybridization work was initiated on 27th October 2020 and concluded on 5th December 2020. Totaly 426 bi-parental crosses, 342 general collections and 10 poly crosses at Coimbatore and 25 wide crosses at Agali, were done and fluff were sent to fluff receiving centres as detailed below.

Table 2.1: Details of crosses made and fluff supplied from NHG during 2020-21

Zone	Bi-parental crosses		General Collections		Polycrosses		Total fluff weight (g)
	No	Fl.wt (g)	No	Fl.wt. (g)	No.	Fl.wt.(g)	
Peninsular Zone	160	3487.5	118	2603.0	5*	369.0	6459.5
East Coast Zone	80	1788.0	56	1149.0	5*	209.0	3146.0
North West Zone	101	2560.0	108	2378.0	5*	317.0	5255.0
North Central & North East Zone	60	1293.0	58	1011.0	5*	104.0	2408.0
Grand total	401	9128.5	342	7141.0	5*	999.0	17268.5
NDHF, Agali	25	775.1	-	-			775.1
Coimbatore and Agali	426	9903.6	342	7141.0	10*	999.0	18043.6

*Excluding duplicates

Zone wise and centre wise crossing programme and seedling raised:

North-West Zone: The centre wise relevant information is given in Table 3.

Uchani

In Uchani, total 42 crosses (station crosses 20, poly 2, general 20) were effected. Total 4717 seedlings were planted while 2754 (58.38%) survived.

Shahjahanpur

The Shahjahanpur centre made 20 bi-parental, 4 poly crosses and 20 general cross. The center received 1067.77 g of fluff. Out of the 1084 seedlings transplanted, 1002 (92.44%) survived.

Kapurthala

Table 3: North West Zone

Name of centre	Cross		Wt. of fluff sown (g)	No. of seedlings transplanted	No of seedlings obtained/gm of fluff sown	No. of seedlings survived	% survival
	Type	No.					
Uchani	Station	20	434	1177	2.71	871	74
	Poly	2	33	24	0.72	16	66.67
	General	20	480	3516	7.32	1867	53.1
	Total	42	947	4717	4.98	2754	58.38
Shahjahanpur	Bi-parental	20	470.50	507	587/1.25	488	96.25
	Poly	04	115.27	185	227/1.97	164	88.65
	General	20	482.00	392	456/0.95	350	89.28
	Total	44	1067.77	1084	1270/1.19	1002	92.44
Kapurthala	Bi-parental	20	574	2295	4.0	2210	96.29
	Poly	03	40	205	5.0	185	90.24
	General	15	372	3200	8.6	2580	80.62
	Total	38	986	5700	5.78	4975	87.28



	Bi-parental	24	-	1915	-	-	-
	Poly	08	-	610	-	-	-
Pantnagar	General	45	-	2605	-	-	-
	Total	77	-	5130	-	-	-
Gurdaspur (Recently shifted from faridkot)	Bi-parental	15	352	3087	8.77	2288	74.12
	General	4	113.5	669	5.89	472	70.55
	Total	19	465.5	3756	-	2760	-

North Central & North East Zone: The centre wise relevant information is given in Table 4.

Pusa

There were total 42 crosses made by the Pusa centre comprising bi-parental 20, poly crosses 4 and general cross 18. The centre received 990 g fluff. Out of the 5152 seedlings planted, 3446 survived.

Bethuadahari

Total 41 crosses were made by the Bethuadahari centre and the centre received 691 g fluff. Out of the 5074 seedlings planted, 4522 survived.

Table 4. North Central & North East Zones

Name of centre	Cross		Wt. of fluff sown (g)	No. of seedlings transplanted	No of seedlings obtained/gm of fluff sown	No. of seedlings survived	% survival
	Type	No.					
Bethuada-hari	Bi-parental	20	342.0	2818	8.24	2538	90.06
	Poly	1	15.0	21	1.4	18	85.71
	General	20	334.0	2235	6.69	1966	87.96
	Total	41	691.0	5074	7.34	4522	89.12
Pusa	Bi-parental	20	480	2794	5.82	1816	65.00
	Poly						
	(a)Current	2	49	10	0.20	6	60.00
	(b)stored	02	39	86	2.21	55	63.95
	General	18	422	2242	5.31	1569	69.98
	Total	42	990	5152	5.20	3446	66.89

Peninsular Zone: The centre wise relevant information is given in Table 5.

Navsari

Total 44 crosses were made by the Navsari centre, comprising biparental cross 20, poly crosses 5 and general cross 15. The centre received 1076 g fluff. Out of the 5384 total seedlings planted, 5111 survived.

Thiruvalla

The centre effected total 40 crosses including biparental 20, poly crosses 5 and general cross 15. The center received 659

g of fluff.

Rudrur

In Rudrur centre, total 39 crosses comprising of biparental cross 20, poly crosses 5 and general cross 14. The centre received 880 g of fluff. Of the 4231 total seedlings planted, 3831 (91%) survived.

Pune:

The centre made total 45 crosses comprised of 22 station cross, 5 poly cross and 15 general cross. Total 4754 seedlings were planted.

Table 5. Peninsular Zone

Name of centre	Cross Type	No.	Wt. of fluff sown (g)	No. of seedlings transplanted	No of seedlings obtained/gm of fluff sown	No. of seedlings survived	% survival
Navsari	Bi-parental	20	494	3508	7	3391	96
	Poly	5	46	376	8	359	95
	General	15	406	1234	3	1195	96
	Agali	4	130	266	2	166	62
	Total	44	1076	5384	-	5111	-
		Bi-parental	20	391	-	5.22	-
Thiruvalla	Poly	5	44	-	2.66	-	-
	General	15	224	-	5.61	-	-
	Total	40	659				
Rudrur	Bi-parental	20	429	1635	3.81	1459	89
	Poly	5	56	401	7.16	351	88
	General	14	395	2195	5.56	2021	92
	Total	39	880	4231	5	3831	91
	Station	20	325.0	785	3.36		
Pune	Poly	05	43.0	322	7.78		
	General	15	455.0	3521	12.09		
	Agali	05	190.30	126	0.74		
	Total	45	1013.3	4754	-		



East Coast Zone: The centre wise relevant information is given in Table 6.

Cuddalore

This centre effected total 46 crosses including bi-parental cross 26, poly crosses 5 and general cross 15 and received 890.3 g of fluff. Out of the 7702 seedlings planted, 7520 (97.64%) survived.

Vuyyuru

At Vuyyuru centre, total 40 crosses were made which comprised bi-parental cross 20, poly crosses 5 and general cross 15. The centre received 717.76 g of fluff. Out of the 3045 total seedlings planted, 1770 (58.13%) survived. The

centre observed an average 4.24 seedlings per g of fluff.

Nayagarh

This centre effected total 39 crosses including bi-parental cross 20, poly crosses 5 and general cross 14 and received 701g of fluff. Out of the 4938 seedlings planted, 3599 seedlings (72.88%) survived.

Anakapalle

This centre effected total 40 crosses including station cross 21 station cross, poly crosses 5 and 14 general crosses. Total 2894 seedlings were planted and 2651 seedlings survived recording 91.6% survival.

Table 6. East Coast Zone

Name of centre	Cross		Wt. of fluff sown (g)	No. of seedlings transplanted	No of seedlings obtained/g of fluff sown	No. of seedlings survived	% survival
	Type	No.					
Cuddalore	Bi-parental	26	611.3	4688	7.67	4601	98.14
	Poly	5	49	59	1.20	55	93.22
	General	15	230	2955	12.85	2864	96.92
	Total	46	890.3	7702	8.65	7520	97.64
Vuyyuru	Bi-parental	20	435.0	1039	2.39	572	55.10
	Poly	5	61.0	330	5.41	209	63.33
	General	15	221.76	1676	7.56	989	59.01
	Total	40	717.76	3045	4.24	1770	58.13
	Bi-parental	20	392	1968	5.02	1472	74.80
	Poly	05	48	316	6.58	241	76.27
	Total	40	693	2894	4.18	2651	91.60
Nayagarh	General	14	261	2654	10.17	1886	71.06
	Total	39	701	4938	7.04	3599	72.88
	Station	21	363	1597	4.40	1458	91.30
	Poly	05	51	200	3.92	179	89.50
Anakapalle	General	14	279	1097	3.93	1014	92.43
	Total	40	693	2894	4.18	2651	91.60

B. II Zonal Varietal Trial

North-west zone

All ten centres of this zone comprising Gurdaspur, Karnal, Kota, Lucknow, Kapurthala, Mujaffarnagar, Pantnagar, Shahjahanpur, Sriganagar and Uchani were assigned the experimental trials of early and mid-late group of genotypes. The results of trials of these centres on pooled analysis of data are summarized here as under.

IVT Early

In IVT early, 7 genotypes viz. CoLk 17201, CoLk 17202, CoLk 17203, CoPb 17211, CoPb 17212, CoPant 17221 and CoS 17231 were evaluated with three standards CoJ 64, Co 0238 and Co 05009. Among the standards, Co 0238 was the best which recorded the highest sucrose, CCS yield (11.35 t/ha) and sugarcane yield (93.24 t/ha) with comparable pol (17.9%) in juice. Among genotypes, CoS recorded the highest CCS yield (10.83 t/ha) and sucrose % in juice (17.81). However, CoPant 17221 recorded the highest sugarcane yield (92.22 t/ha-Table 7).

AVT Early Plant I

Six genotypes viz., Co 15025, Co 16029, CoLk 14201, CoLk 16201, CoLk 16202 and CoPb 16181 of early group were tested against three standards CoJ 64, Co 0238 and Co 05009. Co 0238 was the best standards. Among genotypes, CoLk 14201 recorded the highest CCS yield (11.54 t/ha) and sucrose % in juice (18.01) with comparable sugarcane

yield. However, CoLk 16202 and CoLk 16201 also recorded almost similar values of CCS yields (Table 8).

AVT Early II Plant

In this, six genotypes viz., Co 15023, Co 15024, Co 15027, CoLk 15201, CoLk 15205 and CoPb 15212 were evaluated with three standards CoJ 64, Co 0238 and Co 05009. Among testing genotypes, Co 15027 recorded the highest CCS (13.54 t/ha) over the best check Co 0238 (11.67 t/ha). However, Co 15023 recorded the highest sucrose in juice (19.05%) with comparable CCS (12.33 t/ha) and sugarcane yield (91.96 t/ha). CoLk 15201 recorded 12.03 t/ha CCS yield having 17.42% sucrose in juice (Table 9).

AVT Early Ratoon

All the genotypes tested under plant crop II were evaluated for their performance in ratoon crop against the same standards. Co 15027 recorded the highest CCS (11.65 t/ha) and sugarcane yield (98.22 t/ha). Co 15023 recorded the highest sucrose (18.58%) and comparable CCS and sugarcane yields (Table 10).

IVT Mid-late

Under IVT (midlate) fifteen genotypes were tested against three standards viz., CoS 767, CoPant 97222 and Co 05011. Among the standards, Co 05011 recorded the highest sucrose in juice (18.41%) while CoPant 97222 recorded CCS 11.56 t/ha. The genotype, CoPb 17214 recorded the highest CCS (14.27 t/ha) and sugarcane yield of 114.38



t/ha. However, the highest sucrose in juice (18.96%) was obtained with Co 17018 having comparable yields of CCS (12.68 t/ha) and sugarcane (96.57 t/ha). CoS 17233 recorded 18.5 % sucrose in juice alongwith 96.61 t/ha sugarcane yield and 12.56 t/ha CCS yield (Table 11).

AVT Mid-late Plant I

Total five entries viz. Co 16030, CoLk 16203, CoLk 16204, CoS 16232 and CoS 16233 were tested against CoS 767, CoPant 97222 and Co 5011. CoS 16233 recorded the highest sucrose (19.17%) in juice and CCS yield of 13.25 t/ha. CoLk 16203 recorded 18.18 % sucrose in juice and CCS yield of 11.37 t/ha (Table 12).

AVT Mid-late Plant II

In this trial, seven genotypes were tested against three standards. A cursory glance over data revealed that the sucrose % in juice obtained with CoLk 15207 (19.29) was the highest among all the clones. With moderate yield level (90.51 t/ha), it recorded 12.16 t/ha CCS yield which was fairly on par with the standard check. However, the highest CCS yield (13.48 t/ha) was recorded with CoS 15233 owing to the highest sugarcane yield of 109.02 t/ha (Table 13).

AVT Mid-late ratoon

All the entries and standards tested in AVT plant II were evaluated in ratoon. Co 05011 was found to be the best standard. As compared with the best standard, none of the clones tested recorded higher CCS yield than the best standard (Table 14).

Table 7: Performance of genotypes under IVT (Early)

Genotypes	IVT (Early)		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoLk 17201	9.92	87.43	16.58
CoLk 17202	8.95	76.34	17.01
CoLk 17203	9.17	78.88	16.86
CoPb 17211	8.41	78.50	15.62
CoPb 17212	9.83	86.96	16.39
CoPant 17221	10.56	92.22	16.71
CoS 17231	10.83	88.26	17.81
Stds			
CoJ 64	9.49	77.84	17.90
Co 0238	11.35	93.24	17.77
Co 05009	9.86	81.35	17.44
CV(%)	16.98	15.70	3.99
SE(d)	0.78	6.22	0.32
LSD at 5%	1.56	12.40	0.63

Table 8: Performance of genotypes under AVT (E)- I Plant

Genotypes	AVT (E) – I Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 15025	10.74	87.15	17.67
Co 16029	10.72	87.46	17.61
CoLk 14201	11.54	92.54	18.01
CoLk 16201	11.16	94.60	16.96
CoLk 16202	11.45	93.03	17.76
CoPb 16181	10.42	89.31	16.98
Stds			
CoJ 64	9.84	79.98	17.74
Co 0238	12.30	98.23	18.03
Co 05009	10.39	85.23	17.52
CV(%)	14.24	12.77	3.56
SE(d)	0.69	5.12	0.28
LSD at 5%	1.39	10.21	0.55

Table 9: Performance of genotypes under AVT (E)- II Plant

Genotypes	AVT (E) – II Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 15023	12.33	91.96	19.05
Co 15024	10.99	89.15	17.63
Co 15027	13.54	107.87	17.89
CoLk 15201	12.03	99.51	17.42
CoLk 15205	10.46	82.99	17.88
CoPb 15212	10.86	88.95	17.46
Stds			
CoJ 64	10.41	80.65	17.91
Co 0238	11.67	94.42	17.85
Co 05009	10.98	88.07	17.83
CV(%)	15.98	14.37	3.91
SE(d)	0.86	6.19	0.32
LSD at 5%	1.72	12.38	0.65



Table 10: Performance of genotypes under AVT (E)- Ratoon

Genotypes	AVT (E) - Ratoon		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 15023	10.35	79.14	18.58
Co 15024	10.14	83.76	17.36
Co 15027	11.65	98.22	15.80
CoLk 15201	10.95	91.21	16.27
CoLk 15205	9.96	79.57	16.97
CoPb 15212	10.11	85.81	15.93
Stds			
CoJ 64	9.85	77.98	16.94
Co 0238	10.75	85.58	16.75
Co 05009	9.88	80.89	16.29
CV(%)	15.20	13.31	7.83
SE(d)	1.00	7.12	0.83
LSD at 5%	NS	NS	NS

Table 11: Performance of genotypes under IVT (Mid-late)

Genotypes	IVT (Mid-late)		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 17018	12.68	96.57	18.96
CoLk 17204	10.69	83.14	18.38
CoLk 17205	9.97	83.90	17.60
CoPb 17213	11.72	92.65	18.26
CoPb17214	14.27	114.38	17.56
CoPb 17215	12.29	102.46	17.63
CoPant 17223	13.40	109.15	17.52
CoPant 17224	11.10	101.59	16.03
CoS 17233	12.56	96.61	18.50
CoS 17234	12.01	96.77	17.83
CoS 17235	12.61	101.88	18.08
CoS 17236	12.23	99.25	17.48
CoS 17237	10.68	84.87	17.64
CoH 17261	10.72	84.27	18.44
CoH 17262	9.96	75.98	18.62
Stds			
CoS 767	10.38	84.72	17.74
CoPant 97222	11.56	91.53	18.28
Co 05011	11.30	88.55	18.41
CV(%)	16.47	15.24	5.25
SE(d)	0.90	6.73	0.44
LSD at 5%	1.79	13.32	0.87

Table 12: Performance of genotypes under AVT (M)- I Plant

Genotypes	AVT (M)- I Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 16030	13.23	104.21	17.85
CoLk 16203	11.37	88.87	18.18
CoLk 16204	12.11	96.16	17.99
CoS 16232	12.59	101.08	18.08
CoS 16233	13.25	100.26	19.17
Stds			
CoS 767	10.71	85.70	17.86
CoPant 97222	11.42	88.98	18.67
Co 05011	11.71	87.55	18.86
CV(%)	11.34	10.00	3.74
SE(d)	0.68	4.70	0.34
LSD at 5%	1.37	9.45	0.68



Table 13: Performance of genotypes under AVT (M)- II Plant

Genotypes	AVT (M) – II Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 15026	11.94	91.92	18.71
CoLk 15206	12.35	94.50	18.76
CoLk 15207	12.16	90.51	19.29
CoLk 15209	10.98	86.01	18.43
CoPb 15213	11.67	91.33	18.43
CoS 15232	12.84	99.97	18.62
CoS 15233	13.48	109.02	17.84
Stds			
CoS 767	10.92	86.02	18.27
CoPant 97222	11.82	92.02	18.63
Co 05011	11.79	90.32	18.79
CV(%)	12.20	11.67	3.01
SE(d)	0.69	5.12	0.26
LSD at 5%	1.37	10.21	0.52

Table 14 : Performance of genotypes under AVT (M)- Ratoon

Genotypes	AVT (M) - Ratoon		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 15026	7.71	65.37	17.11
CoLk 15206	9.18	76.49	17.41
CoLk 15207	9.15	74.07	17.92
CoLk 15209	8.88	74.01	17.40
CoPb 15213	8.85	72.85	17.51
CoS 15232	9.15	77.93	17.07
CoS 15233	9.13	78.74	16.88
Stds			
CoS 767	8.51	72.83	16.98
CoPant 97222	9.11	76.19	17.28
Co 05011	9.58	79.16	17.51
CV(%)	15.42	14.59	3.22
SE(d)	0.64	5.14	0.26
LSD at 5%	NS	NS	0.52

North Central and North-East Zone

Total eight experiments (four in early and four in mid-late group) were conducted by five centers viz. Bethuadahari, Buralikson, Motipur, Pusa and Seorahi and the data received from the centers were analyzed.

IVT Early

In IVT early group, eight genotypes were evaluated against the standard/checks CoLk 94184, CoSe 95422 and CoSe 01421. The CoLk 94184 was the best standard. CoP 17437 and CoP 17438 recorded CCS and sugarcane yields numerically higher than the best check. These clones recorded almost similar values of sucrose in juice which ranged from 17.56 to 17.61% (Table 15).

AVT Early Plant I

In this, five genotypes viz CoP 16437, CoP 16438, CoLk 16466, CoLk 16468 and CoSe 16451 were evaluated against CoLk 94184, CoSe 95422 and CoSe 01421. The genotype 16437 recorded the higher yields of CCS (10.51 t/ha) and sugarcane (85.43 t/ha-Table 16).

AVT Early Plant II

Five entries viz CoP 15436, CoSe 15452, CoSe 15455, CoLk 15466 and CoLk 15467 were evaluated with three

standards CoLk 94184, CoSe 95422 and CoSe 01421. Genotype, CoP 15436 recorded the highest yields of CCS (11.58 t/ha) and sugarcane yield (94.81 t/ha) followed by CoLk 15466 which recorded CCS and Sugarcane yields as 11.19 t/ha and 92 t/ha, respectively (Table 17).

AVT Early Ratoon

All the genotypes tested in AVT early plant II were evaluated for their performance in ratoon crop. CoLk 15466 recorded higher CCS (8.74 t/ha) and sugarcane yield (72.91 t/ha) (Table 18).

IVT Mid-late

Six entries were tested against three standards. Among checks, CoP 9301 performed better. None of test entries recorded higher sucrose content in juice than the best check. However, the test values were statistically nonsignificant. The highest sugarcane yield was recorded by CoSe 16456 which also recorded the highest CCS yield of 10.95 t/ha (Table 19).

AVT Mid-late Plant I

In this trial, four entries viz. CoP 16439, CoLk 16470, CoSe 16452 and CoBln 16502 were tested against three standards BO 91, CoP 9301 and CoP 06436. Among test entries, CoLk



16470 recorded the highest CCS (10.36 t/ha) and sugarcane yield (86.91 t/ha). The data on sugarcane yield and CCS yield are non significant (Table 20).

AVT Mid-late Plant II

In this seven entries were evaluated with three standards viz. BO 91, CoP 9301 and CoP 06436. Among the checks, CoP 9301 showed better performance. Among test entries, CoSe 15453 recorded the highest CCS (11.06 t/ha) and sugarcane yield (89.91 t/ha). The data on sugarcane yield, and CCS yield are non significant (Table 21).

AVT Mid-late Ratoon

In this all the seven entries were evaluated with three standards viz. BO 91, CoP 9301 and CoP 06436. Among test entries, CoLk 15468 recorded the highest CCS (8.59 t/ha) and sugarcane yield (72.35t/ha). The data on sugarcane yield, CCS yield and sucrose % in juice were found to be non significant. However, the highest sucrose in juice (17.65%) was recorded in CoP 15438 with moderate sugarcane yield of 68.67 t/ha (Table 22).

Table 15: Performance of genotypes under IVT (Early)

Genotypes	IVT (Early)		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoSe 16454	10.32	85.48	17.47
CoP 17436	9.91	84.21	17.05
CoP 17437	10.46	86.01	17.56
CoP 17438	10.64	87.47	17.61
CoP 17440	9.98	86.58	16.70
CoP 17441	10.85	93.06	16.83
CoSe 17451	10.19	84.37	17.36
CoBln 17501	7.40	66.39	15.98
Std			
CoLk 94184	9.95	82.01	17.55
CoSe 95422	9.12	77.60	16.99
CoSe 01421	9.34	77.52	17.49
CV(%)	13.00	11.74	2.40
SE(d)	0.90	6.87	0.29
LSD at 5%	1.84	NS	0.59

Table 16: Performance of genotypes under AVT (Early)- I Plant

Genotypes	AVT (Early) – I Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoP 16437	10.51	85.43	17.93
CoP 16438	9.26	78.67	17.09
CoLk 16466	10.17	83.92	17.60
CoLk 16468	9.97	77.77	17.45
CoSe 16451	9.78	77.25	17.70
Std			
CoLk 94184	9.50	78.05	17.69
CoSe 95422	9.11	76.44	17.01
CoSe 01421	9.44	76.72	17.61
CV(%)	18.99	18.28	1.94
SE(d)	1.16	9.16	0.21
LSD at 5%	NS	NS	0.43

Table 17: Performance of genotypes under AVT (Early)- II Plant

Genotypes	AVT (Early)- II Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoP 15436	11.58	94.81	17.68
CoSe 15452	10.55	87.04	17.51
CoSe 15455	8.76	73.93	17.16
CoLk 15466	11.19	92.00	17.65
CoLk 15467	9.94	82.97	17.32
Standards			
CoLk 94184	10.51	87.00	17.66
CoSe 95422	9.21	78.97	16.84
CoSe 01421	9.62	80.34	17.18
CV(%)	10.72	10.33	2.08
SE(d)	0.77	6.18	0.25
LSD at 5%	1.60	12.8	0.53



Table 18: Performance of genotypes under AVT (Early)- Ratoon

Genotypes	AVT(E)- Ratoon		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoP 15436	8.29	69.84	17.14
CoSe 15452	7.50	63.81	16.93
CoSe 15455	8.31	71.25	16.68
CoLk 15466	8.74	72.91	17.15
CoLk 15467	7.87	65.28	17.34
Standards			
CoLk 94184	7.99	66.62	17.16
CoSe 95422	7.71	66.61	16.29
CoSe 01421	7.48	63.09	16.84
CV(%)	16.64	15.62	3.01
LSD (5%)	NS	NS	1.30

Table 19: Performance of genotypes under IVT (Mid-late)

Genotypes	IVT (Mid-late)		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoSe 16455	9.55	85.19	16.27
CoSe 16456	10.95	92.18	17.31
CoP 17444	9.96	83.48	17.25
CoP 17446	10.15	85.13	17.20
CoSe 17452	9.54	80.27	17.15
CoBln 17502	6.98	62.40	16.22
Std			
BO 91	9.35	80.36	17.20
CoP 9301	10.27	83.73	18.10
CoP 06436	10.18	87.86	16.82
CV(%)	14.40	13.79	4.43
SE(d)	0.98	8.02	0.53
LSD at 5%	2.02	NS	NS

Table 20: Performance of genotypes under AVT (Mid-late) –I Plant

Genotypes	AVT (Mid-late) –I Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoP 16439	9.42	79.93	17.43
CoLk 16470	10.36	86.91	17.44
CoSe 16452	9.46	79.95	17.30
CoBln 16502	8.10	71.23	16.51
Stds.			
BO 91	9.50	79.18	17.32
CoP 9301	10.01	82.30	17.89
CoP 06436	10.05	84.52	17.11
CV(%)	18.57	18.66	2.38
SE(d)	1.12	9.51	0.26
LSD at 5%	NS	NS	0.53

Table 21: Performance of genotypes under AVT (Mid-late) –II Plant

Genotypes	AVT (Mid-late) –II Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoP 15438	9.62	80.74	16.00
CoP 15439	10.66	87.09	16.37
CoP 15440	10.46	87.36	16.42
CoSe 15453	11.06	89.91	16.50
CoSe 15454	10.50	88.82	15.77
CoLk 15468	9.00	73.90	16.44
CoLk 15469	8.62	68.10	16.84
Standards			
BO 91	9.77	83.18	15.88
CoP 9301	10.08	81.14	16.84
CoP 06436	9.48	78.00	16.19
CV(%)	13.53	13.60	3.38
SE(d)	0.84	7.03	0.34
LSD at 5%	NS	NS	0.70

**Table 22: Performance of genotypes under AVT (Mid-late) –Ratoon**

Genotypes	AVT (Mid-late) Ratoon		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoP 15438	8.54	68.67	17.65
CoP 15439	7.64	61.63	17.44
CoP 15440	7.87	68.01	16.62
CoSe 15453	8.04	65.94	17.50
CoSe 15454	8.02	68.61	17.22
CoLk 15468	8.59	72.35	17.18
CoLk 15469	7.83	66.85	16.92
Stds			
BO91	7.59	64.19	16.72
CoP 9301	7.92	64.19	17.62
CoP 06436	8.49	71.88	16.92
CV(%)	15.47	15.13	3.38
SE(d)	0.78	6.43	0.36
LSD at 5%	NS	NS	NS

East coast zone

The East coast zone comprises Anakapalle, Cuddalore, Nayagarh, Nellikuppam and Vuyyuru and these centers constitute coastal region of Odisha, A.P and Tamil Nadu. Total six experiments (except IVT ML and AVT Plant I) were assigned to all the five centres.

IVT Early

Three genotypes viz., CoV 18356, CoV 18357 and CoOr 18346 along with three standards CoA 92081, CoC 01061 and CoA 11321 were tested. Among the test entries CoV 18356 recorded the highest sucrose in juice (18.49%) followed by CoV 18357 (18.22%). The highest yields of CCS and sugarcane were also recorded by these clones which recorded as 15.33 and 15.32 t/ha, respectively (Table 23).

AVT Early I Plant

Three genotypes viz. CoA 17321, CoA 17323 and CoC 17336 were tested against three standards CoA 92081, CoC 01061 and CoOr 03151. None of the test entries could perform better than the best check of CoA 92081 which recorded the highest CCS (14.02 t/ha). However, CoC 17336 recorded the highest sugarcane yield of 120.8 t/ha and CCS 13.71 t/ha (Table 24).

AVT Early Plant II

Four test entries included CoA 16321, CoC 13336, CoC 16337 and CoV 16356 were evaluated against three standards CoA 92081, CoC 01061 and CoOr 03151. Among testing genotypes, CoV 16356 recorded the highest CCS (14.83 t/ha) and sugarcane yield 118.82 t/ha. CoA

16321 recorded the highest sucrose in juice (18%) and recorded CCS yield of 14.13 t/ha (Table 25).

AVT Early Ratoon

In this four genotypes viz. CoA 16321, CoC 16336, CoC 16337 and CoV 16356 were tested against three checks viz. CoA 92081, CoC 01061 and CoOr 03151. The test Genotypes CoA 116321 and CoC 16337 recorded numerically higher CCS (12.73 t/ha & 12.46 t/ha) than other clones and checks. Among the tested genotypes the highest sugarcane yield was recorded with 111.03 t/ha (Table 26).

AVT Midlate Plant II

In this, five genotypes including CoC 15339, CoOr 15346, CoC 16338, CoC 16339 and CoV 16357 were evaluated against three standards of CoV 92102, Co 86249 and Co 06030. It was observed that the standard Co 06030 recorded the highest sucrose in juice (18.3%) while another standard CoV 92102 recorded the highest CCS (15.32 t/ha) and sugarcane yield (120.14 t/ha). Among test entries CoC 16338 recorded the highest CCS yield of 14.56 t/ha and sugarcane yield of 120.2 t/ha (Table 27).

AVT Midlate ratoon

All five genotypes viz. CoC 15339, CoOr 15346, CoC 16338, CoC 16339 and CoV 16357 were evaluated against three genotypes of CoV 92102, Co 86249 and Co 06030. It was observed that CoV 16357 recorded the highest CCS (12.45 t/ha) and sucrose in juice (18.09%). while another clone CoC 16338 recorded CCS yield of 12.36 t/ha along with sucrose content of 17.22% in juice (Table 28).

Table 23: Performance of genotypes under IVT (Early)

Genotypes	IVT (Early)		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoV 18356	15.32	118.38	18.49
CoV 18357	15.33	119.95	18.22
CoOr 18346	11.57	100.89	16.58
Standards			
CoA 92081	12.91	110.71	16.96
CoC 01061	12.31	100.74	17.49
CoA 11321	13.45	116.80	16.73
CV(%)	15.97	14.09	5.64
SE(d)	1.36	9.91	0.62
LSD at 5%	NS	NS	1.29



Table 24: Performance of genotypes under AVT (Early) – I Plant

Genotypes	AVT (Early) – I Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoA 17321	13.36	113.17	16.87
CoA 17323	12.88	107.67	17.18
CoC 17336	13.71	120.80	16.37
Standards			
CoA 92081	14.02	116.14	17.30
CoC 01061	11.96	97.48	17.46
CoOr 03151	13.16	116.18	16.31
CV(%)	10.13	8.80	4.73
SE(d)	0.84	6.23	0.50
LSD at 5%	NS	12.99	NS

Table 25: Performance of genotypes under AVT (Early) – II Plant

Genotypes	AVT (Early) – II Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoA 16321	14.13	112.69	18.00
CoC 16336	13.93	116.82	17.26
CoC 16337	13.34	117.75	16.44
CoV 16356	14.83	118.82	17.88
Standards			
CoA 92081	13.28	111.48	17.13
CoC 01061	12.70	102.85	17.75
CoOr 03151	13.47	119.04	16.45
CV(%)	9.86	8.48	4.25
SE(d)	0.85	6.12	0.46
LSD at 5%	NS	NS	0.95

Table 26: Performance of genotypes under AVT (Early) – Ratoon

Genotypes	AVT (Early) – Ratoon		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoA 16321	12.73	109.26	15.86
CoC 16336	11.46	97.57	15.86
CoC 16337	12.46	111.03	15.23
CoV 16356	12.03	102.85	15.77
Standards			
CoA 92081	11.50	104.53	15.16
CoC 01061	11.11	93.71	16.01
CoOr 03151	11.04	102.10	14.71
CV(%)	13.54	12.15	5.17
SE(d)	1.00	7.91	0.50
LSD at 5%	NS	NS	NS

Table 27: Performance of genotypes under AVT (Mid-late) – II Plant

Genotypes	AVT (Mid-late) – II Plant		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoC 15339	13.84	114.68	17.34
CoOr 15346	14.0	112.72	17.79
CoC 16338	14.56	120.20	17.31
CoC 16339	13.90	119.27	16.77
CoV 16357	13.93	114.33	17.71
Stds			
CoV 92102	15.32	120.14	17.58
Co 86249	13.01	112.97	16.69
Co 06030	14.75	115.05	18.30
CV(%)	11.58	8.90	5.02
SE(d)	1.03	6.53	0.55
LSD at 5%	NS	NS	NS

**Table 28: Performance of genotypes under AVT (Mid-late) – Ratoon**

Genotypes	AVT (Mid-late) – Ratoon		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
CoC 15339	11.51	94.64	17.47
CoOr 15346	11.32	93.62	17.29
CoC 16338	12.36	102.18	17.22
CoC 16339	12.03	101.91	17.14
CoV 16357	12.45	101.91	18.09
Stds			
CoV 92102	12.22	98.03	17.79
Co 86249	11.62	99.83	16.91
Co 06030	10.58	85.63	18.00
CV(%)	12.88	13.08	5.02
SE(d)	0.95	8.04	0.55
LSD at 5%	NS	NS	NS

Peninsular zone

In view of developing high yielding and high sucrose varieties following experiments were assigned to all the 19 centres of the zone situated at Akola, Basmathnagar, Belagavi, Coimbatore, Kolhapur, Mandya, Navsari, Padegaon, Perumalapalle, Powarkheda, Pravaranagar, Pune, Pugalur, Kawardha (Raipur), Rudrur, Sameerwadi, Sankeshwar, Sirugamani and Thiruvalla. The results are summarized here under-

IVT

Eighteen genotypes were evaluated against three standards viz. Co 86032, CoC 671 and Co 09004. Co 86032 was the best check which recorded CCS yield 17.18 t/ha and sugarcane yield 125.99 t/ha. Among test entries Co 17001 and Co 17003 recorded 15.77 t/ha and 15.41 t/ha CCS yields, respectively (Table 29).

AVT Plant I

In this twelve entries were tested against three standards viz. Co 86032, CoC 671 and Co 09004. Among genotypes, Co 11015 recorded the highest sucrose in juice (20.74%)

alongwith comparable sugarcane yield of 115.94 t/ha and CCS yield 16.92 t/ha while Co 14005 recorded the highest CCS (17.44 t/ha) and sugarcane yield (125.43 t/ha) (Table 30).

AVT Plant II

Fifteen genotypes were evaluated against three standards of Co 86032, CoC 671 and CoSnk 05103. The standard Co 86032 performed better in terms of sugarcane yield (125.26 /ha) and CCS (17.06 t/ha) with moderate sucrose (19.39%) in juice. However, the standard check CoC 671 recorded the highest sucrose (20.36%) in juice. Among the testing entries, MS 14082 recorded the highest CCS yields (18.38 t/ha) and sugarcane yield of 138.04 t/ha (Table 31).

AVT Ratoon

In this, fifteen genotypes were evaluated against three standards of Co 86032, CoC 671 and CoSnk 05103. The pooled data on cane yield, sucrose content and commercial sugar indicated that MS 14082 recorded the highest CCS yield (16.72 t/ha) and sugarcane yield (120.34 t/ha) with moderate sucrose % juice (19.44%) (Table 32).

Table 29: Performance of genotypes under IVT

Genotypes	IVT		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 17001	15.77	115.64	19.65
Co 17002	15.12	113.23	19.15
Co 17003	15.41	109.15	20.19
Co 17004	15.55	118.30	18.86
Co 17005	16.57	117.46	19.98
Co 17006	13.14	94.73	19.63
Co 17008	11.99	89.89	19.33
Co 17010	14.73	107.49	19.59
Co 17012	15.45	117.31	18.89
Co 17013	14.65	111.01	18.92
Co 17014	12.93	97.92	18.73
CoVC 17061	15.28	119.64	18.36
CoN 17071	14.10	107.21	18.88
CoN 17072	13.83	111.05	18.00
MS 17081	14.81	119.44	17.82
MS 17082	16.27	125.61	18.68
CoVSI 17121	14.80	110.39	18.90
CoT 17366	15.22	117.72	18.60



Stds				
Co 86032	17.18		125.99	19.69
CoC 671	15.82		112.96	20.18
Co 09004	16.10		115.78	19.90
CV(%)	16.24		14.92	4.63
SE(d)	0.89		6.11	0.31
LSD at 5%	1.78		12.02	0.71

Table 30: Performance of genotypes under AVT (I Plant)

Genotypes	AVT (I Plant)			
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice	
Co 11015	16.92	115.94	20.74	
Co 14005	17.44	125.43	19.82	
Co 15005	15.08	108.41	19.84	
Co 15006	15.17	113.78	18.99	
Co 15007	15.78	115.51	19.45	
Co 15009	15.53	117.63	18.97	
Co 15010	15.81	121.21	18.64	
Co 15017	15.43	110.18	20.01	
Co 15021	15.58	115.09	19.44	
CoSnk 15102	15.25	111.97	19.32	
CoN 15071	16.64	124.93	18.91	
PI 15131	15.91	121.55	18.81	
Stds				
Co 86032	16.49	120.31	19.48	
CoC 671	15.06	105.56	20.49	
Co 09004	16.34	114.15	20.12	
CV(%)	12.74	12.47	4.30	
SE(d)	0.74	5.28	0.30	
LSD at 5%	1.45	10.42	0.60	

Table 31: Performance of genotypes under AVT (II Plant)

Genotypes	AVT (II Plant)			
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice	
Co 14002	16.02	118.52	19.27	
Co 14004	15.62	112.71	19.45	
Co 14012	15.79	111.37	19.91	
Co 14016	16.37	124.45	18.85	
Co 14027	16.31	120.29	19.29	
Co 14030	15.18	112.05	19.33	
Co 14032	14.94	108.66	19.52	
CoN 14073	16.53	131.82	17.93	
CoSnK 14102	14.54	114.33	18.22	
CoSnK 14103	13.80	107.77	18.17	
CoT 14367	13.38	108.8	17.77	
CoTI 14111	15.64	121.15	18.18	
CoVC 14062	15.72	116.86	19.30	
MS 14081	15.33	113.05	19.11	
MS 14082	18.38	138.04	19.04	
Stds				
Co 86032	17.06	125.26	19.39	
CoC 671	16.24	112.70	20.36	
CoSnk 05103	15.22	119.86	18.45	
CV(%)	14.39	13.47	4.17	
SE(d)	0.85	5.991	0.29	
LSD at 5%	1.68	11.80	0.58	



Table 32: Performance of genotypes under AVT (R)

Genotypes	AVT (R)		
	CCS (t/ha)	Cane yield (t/ha)	Sucrose (%) in juice
Co 14002	14.07	100.18	19.40
Co 14004	13.63	95.53	19.56
Co 14012	13.77	93.99	19.94
Co 14016	14.86	109.58	18.76
Co 14027	13.44	96.57	19.33
Co 14030	13.18	96.35	19.15
Co 14032	13.23	92.70	19.80
CoN 14073	14.46	110.93	18.03
CoSnk 14102	13.16	98.39	18.42
CoSnk 14103	11.95	91.93	18.14
CoT 14367	12.20	92.40	18.46
CoTI 14111	14.84	109.94	18.66
CoVC 14062	14.20	100.74	19.39
MS 14081	13.18	93.34	19.29
MS 14082	16.72	120.34	19.44
Stds			
Co 86032	15.39	109.89	19.29
CoC 671	13.35	90.38	20.32
CoSnk 05103	12.64	96.58	18.11
CV(%)	17.99	16.37	5.02
SE(d)	0.97	6.42	0.37
LSD at 5%	1.91	12.66	0.74

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

This is an important programme for location specific evaluation of climate resilient genetic stocks. The progress has been reported by Pune, Sankeshwar, Pusa, Lucknow and Anakapalle centers.

Pune

The experiment having total 18 entries i.e. ISH 501, ISH 502, ISH 5012, ISH 519, ISH 524, ISH 534, ISH 536, ISH 548, ISH 567, ISH 501 ISH 584, ISH 585, ISH 587, ISH 590, ISH 594, IGH 823, IGH 829, IGH 833 and IGH 834 with three standards CoM 88121, CoM 0265 and VSI 12121 was conducted. The planting was done 15.01.2021 in alpha design. The data revealed that IGH 834, IGH 829, ISH 590, ISH 567 and ISH 536 were found to be drought tolerant genetic stocks as compared with standards.

Sankeshwar

The experiment was conducted as per the technical programme and the planting was done on 31.12.2020. The crop of both the trials is at 240 days with good condition. The irrigations were withheld in drought treatment plots, However, summer rains were witnessed after 113 days stress. The observations are being recorded as per the programme

Pusa

The planting materials were under multiplication. The center has trial under evaluation and identification of

climate resilient ISH and IGH genetic stocks for waterlogging tolerance during current cropping season i.e. 2020-21.

Anakapalle

The experiment was conducted with 13 clones along with three standards. Under drought condition the clones CoS 08279, CoLk 15206 and CoA 14321 (standard) recorded highest germination percent, while the clone CoS 08279 recorded highest shoot population of 122.5 per plot at 120 days after planting.

Lucknow

A. Evaluation and identification of climate resilient ISH and IGH genetic stocks for drought tolerance (Plant crop I)

In this total 18 ISH and IGH clones with three standards were planted under drought as well as normal conditions. The observations are being recorded as per the technical programme.

B. Evaluation and identification of climate resilient Near Commercial Hybrids for drought tolerance (Plant crop I)






In this total 13 Near Commercial Hybrids with three standards were planted under drought as well as normal conditions. The observations are being recorded as per the technical programme.





Sugarcane varieties developed through AICRP on Sugarcane and notified by CVRC during 2021

Varietal Identification Committee meeting was held on 19th October, 2020 during 33rd Biennial Workshop of AICRP on Sugarcane. In this meeting, the following seven sugarcane varieties viz., VSI 12121, Co 13013 (Akshaya), MS 13081 (Phule 10001), Co 15023 (Karan-15), CoLk 14204 (Ikshu-

8), CoPb 14185 (CoPb 98 & CoSe 11453 have been identified. Out of these, three sugarcane varieties such as VSI 12121, Co 13013, (Both mid-late) for Peninsular Zone and Co 15023 (Early) for North West Zone have also been released & notified by Central Varietal Release Committee (CVRC) for commercial cultivation in respective sugarcane growing zones. The sugarcane varieties identified/notified during the period are given as under:

Sl. No.	Description	Photograph
A. Released and notified		
1	VSI 12121: This variety has been developed by VSI, Pune (Maharashtra) in mid-late group and identified in 2020 for Peninsular Zone. The variety has exhibited cane yield (124.70 t/ha), sucrose (%) in juice (20.07) & CCS (18.22 t/ha). This variety is suitable for planting autumn and spring seasons. This variety is tolerant to drought and salinity stresses. This variety has been released & notified by the CVRC during 2021.	
2	Co 13013 (Akshaya): This variety has been submitted by ICAR-SBI, Coimbatore (Tamil Nadu) and identified in 2020 for Peninsular Zone. It is a mid-late maturing clone having cane yield (121.96 t/ha), sucrose (%) in juice (19.01) & CCS (14.75 t/ha). Reaction against red rot was moderately resistant (MR). This variety has been released & notified by the CVRC during 2021.	
3	Co 15023 (Karan-15): This variety has been developed by ICAR-SBI Regional Centre, Karnal (Haryana). It is an early maturing clone and identified in 2020 for North West Zone. The variety recorded cane yield (89.17 t/ha), sucrose (%) in juice (19.41) and CCS (12.16 t/ha). Reaction against red rot was moderately resistant (MR). This variety has been released & notified by the CVRC during 2021.	
A. Identified for release		
1	MS 13081 (Phule 10001): This variety has been developed by the CSRS, Padegaon (Maharashtra) and identified in 2020 for Peninsular Zone. It is an early maturing clone having cane yield (118.51 t/ha), sucrose (%) in juice (19.78) and CCS (16.84 t/ha). Reaction against red rot was moderately resistant (MR).	
2	CoLk 14204 (Ikshu -8): This variety has been developed by ICAR-IISR, Lucknow in mid-late group and identified in 2020 for North West Zone. The variety recorded cane yield (92.73 t/ha), CCS (11.39 t/ha) and sucrose % in juice (17.73). The clone showed disease reaction of moderately resistant (MR) to red rot.	



3	<p>CoPb 14185 (CoPb 98) : This variety has been developed by PAU RS, Faridkot in midlate group and identified in 2020 for North West Zone. The variety has exhibited cane yield (88.99 t/ha), sucrose (%) in juice (18.50) and CCS (11.58 t/ha). Reaction against red rot was moderately resistant (MR).</p>	
4	<p>CoSe 11453: This variety has been developed by the GSSBRI, Seorahi under UPCSR, Shahjahanpur (U.P.). It is a mid -late group and identified in 2020 for North Central & North Eastern Zones. The variety has exhibited cane yield (78.38 t/ha), sucrose (%) in juice (17.21) and CCS (9.59 t/ha). Reaction against red rot was moderately resistant (MR).</p>	

Summary of Crop Improvement

- During the years 2020-21, seven sugarcane varieties viz. VSI 12121, Co 13013 (Akshaya), MS 13081 (Phule 10001), Co 15023 (Karan-15), CoLk 14204 (Ikshu-8), CoPb 14185 (CoPb 98 & CoSe 11453 have been identified in Varietal Identification Committee meeting held on 19th October, 2020.
- Three sugarcane varieties viz., VSI 12121 (Mid-late), Co 13013, (Mid-late) for Peninsular Zone and Co 15023 (Early) for North West Zone have also been released & notified by Central Varietal Release Committee (CVRC) for commercial cultivation in respective sugarcane growing zones.
- NHG 2020-21 was established with 424 parents including nine new parents viz., BO 128, CoP 9301, CoP 18436, CoP 18437 from Pusa, CoV 18357 and CoV 18358 from Vuyyuru LG 11440, LG 14482 and LG 14564 from Lucknow and two poly-cross nurseries for tropical and subtropical region were planted and maintained in pest and disease free condition.
- Out of 424 parents, 411 flowered with the flowering intensity of 96.93%. Since the COVID-19 pandemic had restricted travel during 2020, ICAR-SBI had taken up the responsibility of making the crosses for the entire country.
- The centers were asked to send the list of crosses of their choice based on the lowering data hosted and updated daily in ICAR-SBI website.
- Hybridization work was initiated on 27th October 2020 and concluded on 5th December 2020. Totally 426 biparental crosses, 342 general collections and 10 poly crosses at Coimbatore and 25 wide crosses at Agali, were done and fluff were sent to fluff receiving centres as detailed below.
- A total of 26 Zonal Varietal Trials (12 in early, 10 in midlate and 4 by combining both early and midlate entries) were conducted during the year 2020-21.
- There were 6 IVT and 20 AVT trials. A total of 47 entries in early group, 49 entries in midlate group and 45 entries by combining both early and midlate groups were evaluated, of which 14 in early, 9 in midlate and 6 combining both early and midlate groups were promising.



CROP PRODUCTION

A look on advancements in sugarcane research, its production scenario and the transfer of technology to the stake holders during the recent past evinces encouraging trends and new challenges. On the research front development of new high yielding high sugar varieties supported with suitable production and protection technologies made sugar sector viable on one hand and left ample scope for diversification on the other. During the year 2020-21 as per the latest estimates sugar production is expected to be around 31 million tonnes with sugarcane production of more than 400 million tonnes produced from 5.22 million hectares. The largest sugarcane and sugar producing state of Uttar Pradesh is estimated to produce over 11 million tonnes of sugar by crushing comparatively less cane with a high recovery of 10.76%. The increased production and sugar recovery have provided scope for diverting sugarcane juice, B-heavy molasses and other substrates for the production of ethanol to be used as bio-fuel for automobiles. With the development of high biomass producing sugarcane cultivars, it is required to develop suitable production technologies for enough anchorage to roots to hold the crop from lodging, enhanced water and nutrient use efficiency in view of price escalation of these resources, technologies for bringing in resilience against adverse impacts of climate change and micro and macro level crop and product diversification to enhance the income of sugarcane growers. For the year 2020-21 the trials under Crop Production discipline of AICRP on Sugarcane were designed and carried out to develop recommendations for addressing these issues. These were concentrated on aspects such as agronomic evaluation of promising genotypes for their performance potential under wide row spacing at enhanced fertility level, extended nutrient management schedule for sugarcane production system to ensure soil health and crop productivity, and also to assess the water productivity and drought tolerance potential of newly released varieties of sugarcane. Most of the centres carried out these trials in the true research spirit and reported the results as per the prescribed format. A summary table showing no. of centres allotted, conducted and not conducted the stipulated experiments during 2020-21 is given in Appendix I.

The experiment wise summary of the results are presented below:

AS-72: Agronomic performance of elite sugarcane genotypes

The trial was initiated during 2016-17 and was allotted to all the centres. During the year (2020-21) 13 centres reported the results. Centre wise summary of findings for the year are given below:

NORTH WEST ZONE

1. FARIDKOT

For early maturing genotypes, although interaction

between fertilizer levels and genotypes was non-significant but yield of all the genotypes were better at 125% RDF over that of RDF. The highest cane yield was of Co 15024 (117.8 t/ha) followed by Co 15027 (115.7 t/ha) and CoPb 15212 (110.4 t/ha). The number of millable canes and number of tillers were significantly better at 90 cm spacing than 120 cm. The application of 125% of recommended N gave significantly better millable canes than 100% N. Among mid-late genotypes the highest cane yield was of CoS 15233 (102.4 t/ha) followed by CoS 15232 (101.3 t/ha). The number of millable canes and number of tillers were significantly better at 90 cm spacing than 120 cm but single cane weight was higher at 120 cm row spacing. The application of 125% of recommended N gave significantly better millable canes than 100% N.

2. KOTA

Among early genotypes Co 15027 recorded significantly higher germination, tillers count and cane yield (95.7 t/ha). The genotype recorded higher brix (22.37), sucrose (20.0 %), CCS (13.83 %) and CCS yield (13.34 t/ha) over rest of the genotypes. Among mid-late genotypes CoLk 15209 recorded significantly higher germination, tiller count and cane yield (94.55 t/ha). The genotype recorded higher brix, sucrose and CCS yield (12.99 t/ha) over rest of the genotypes. There was no significant difference in the performance of the genotypes with regard to fertilizer doses.

3. LUCKNOW

A field experiment was initiated to evaluate the performance of different elite genotypes of sugarcane (early and mid-late) at different fertility levels (RDF and 125% RDF of NPK) and at wider spacing. Experiments were planted on 26th February 2020. The crop germination was good but during complete lockdown period, the weeding and irrigation could not be met as per crop requirement. The crop was also damaged by blue bulls leaving very thin plant population. Thus the experiment was vitiated.

4. SHAHJAHANPUR

In early group, standard Co 0238 produced significantly higher cane yield (105.10 t/ha) followed by genotype Co 15023 (98.30 t/ha). In mid-late group genotypes Co 15026 produced significantly higher cane yield (86.20 t/ha) followed by genotype CoLk 15206 (84.0 t/ha). Regarding fertility levels significantly higher cane yield was obtained with 125% recommended dose of NPK than that of 100% RDF of NPK in both early and mid-late genotype. CCS% in cane at harvest was found significantly higher in genotype Co 15023 than that of 15027 and CoPb 15212 genotypes in early group. CCS% in cane at harvest was observed significantly superior in genotype CoLk 15207 over other genotypes except genotype CoPb 15213 in mid-late group.

5. UCHANI



NMC (number of millable cane), cane yield and cane girth were significantly affected due to different spacing in both early and mid-late group. Wider row spacing (120 cm) recorded higher cane weight and cane girth but significantly lower cane yield in both mid late and early group. Higher fertility levels (125% RDF) resulted in significantly higher NMC in early maturing varieties, while no significant effect of fertility levels on NMC was recorded in mid late varieties. Cane yield was significantly higher in 125 % RDF in both early and mid-late genotypes. Among early genotypes, highest number of millable canes were recorded in variety CoLk 15205 (127.06 thousand/ha) which was significantly higher than other varieties. Significantly higher cane weight was recorded in variety Co 15027 (1.32 kg) followed by Co 0238 (1.20 kg). Lowest cane weight was observed in CoLk 15205 which was at par with CoPb 15212. Highest cane yield was recorded in standard check i.e. Co 0238 (103.73 t/ha) followed by Co 15027 (97.16 t/ha) but significantly higher than other varieties. While in mid late genotypes, CoS 15233 variety was found to be the best in terms of cane yield which was at par with CoS 767, but significantly higher than other varieties. Significant interaction for cane yield was observed in spacing and fertility levels with early genotypes. Significant interaction was observed between spacing and mid-late genotypes also. Highest cane yield was recorded in CoS 767 (102.90 t/ha) in 90 cm wide rows which was at par with CoS 15233 (102.33 t/ha) at 90 cm spacing but significantly higher than other varieties under different spacing arrangement.

PENINSULAR ZONE

6. PUNE

The field trial was conducted to assess the performance of various elite sugarcane genotypes under different fertilizer levels. The results of the plant crop indicated that, the maximum cane yield (118.48 t/ha) and CCS yield (15.96 t/ha) secured by fertilizing the crop with 125% RDF. In the case of genotypic performance CoSnK 14102 recorded the maximum germination (69.25%), whereas, CoSnK 14103 performed better in tillering (1.34 lakh/ha), as well as NMC count (0.97 lakh/ha), While cane yield (155.00 t/ha), CCS yield (18.75 t/ha) was higher in CoN 14073. Whereas, CoT 14367 showed superior juice quality.

7. KOLHAPUR

All the cultivars in respect of cane yield and yield parameters did not differ significantly with 100 or 125 % RDF. The interaction effect was found non- significant for all the characters. Within the variety results were found significant. The 125% RDF was numerically superior to 100% RDF in respect of cane yield and yield attributes. Among cultivars/ variety CoN 14073 was significantly superior in cane yield and CCS yield.

8. SANKESHWAR

CCS yield, Number of millable canes (NMC) and cane girth did not differ significantly due to fertilizer levels (100 and

125% RDF). Whereas, application of 125% RDF recorded significantly higher cane yield and single cane weight than application of 100% RDF. Among the cultivars CoN 14073 recorded significantly higher cane yield (136.5 t/ha) which was on par with the cultivars Co 14002 (133.7 t/ha) and Co Snk 14102 (132.9 t/ha). The NMC and single cane weight followed the same trend. Significantly higher cane girth was with cultivar Co14027 and CoT 14367. While significantly higher cane height was with CoT1 14111 (3.4 m) followed by CoN 14073 and MS14081 which were at par with each other.

9. COIMBATORE

Sugarcane cane yield was influenced significantly due to different genotypes wherein, Co 14016 (122.56 t/ha) and Co 14012 (117.98 t/ha) recorded significantly higher cane yield than CoC 671 (77.50 t/ha). Data were recorded on growth, juice quality, cane yield and yield attributes. Cane yield and juice quality were not influenced significantly due to fertilizer levels. Juice Brix, Sucrose (%), Purity (%) and CCS (%) at harvest showed significant varietal differences. Among different entries, Co 14012 recorded significantly higher mean sucrose (%) of 21.16 than Co 86032. Amongst the genotypes Co 14012 was found more promising and recorded significantly higher CCS yield of 18.26 t/ha than the check entries CoC 67 (12.28 t/ha) and Co 86032 (14.46 t/ha).

10. POWARKHEDA

Results revealed that among varieties Co 86032 (127.02), CoSnk 14102 (123.49), Co C 671 (122.57), Co 14016 (122.34), Co 14032 (120.31), CoSnk 05103 (119.15), Co 14002 (118.11), CoN 14073 (117.88), MS 14082 (116.66), Co 14012 (116.32) and CoVC 14062 (113.25) showed higher number of millable cane ('000/ha) than Co 14030 (92.94), Co 14027 (90.74), Co Snk 14103 (90.68), and MS 14081 (81.19). But the cane yield was recorded at par among varieties Co 86032 (127.02), CoSnk 14102 (123.49), CoC 671 (122.57) and Co 14016 (122.34). The cane yield was not influenced significantly due to fertility levels.

EAST COAST ZONE

11. NAYAGARH

The experiment was laid out in randomized block design with four genotypes from AVT viz., CoA 16321, CoC 16336, CoC 16337 and CoV16356 along with three standard check i.e. CoA 92081, CoC 01061 and CoOr 03151 on red laterite soil acidic (pH 5.33) in reaction with electrical conductivity of 0.206 dSm⁻¹. Analysis of variance suggested that there was significant variation among the genotypes with respect to germination%, number of tillers at 180 days and number of millable canes. The genotype CoV 16356 with 120 cm spacing produced the highest average cane yield of 100.35 t/ha with application of 125% RD of fertilizer which is at par with application of 100% RDF (98.05 t/ha).



NORTH CENTRAL ZONE

12. PUSA

Fertility level had significant impact on plant population, plant height, millable canes and cane yield. Higher shoot count (147400/ha), plant height (301.8 cm), millable canes (113800/ha) and cane yield (82.3 t/ha) was obtained with 125% recommended dose of NPK. Though, fertility level did not cause significant impact on brix, pol and purity percentage. Among early genotypes CoP 15436 performed better at 90 cm row spacing and 125% fertility level followed by CoSe 15452 and CoLk 15466. For mid-late maturing genotypes CoSe 15454, CoP 15439 and CoSe 15453 performed better at 90 cm row spacing and 125% fertility level.

13. SEORAH

CoSe 15455, CoSe 15452 and CoLk 15466 early genotypes and CoLk 15468, CoLk 15469, CoSe 15453 and CoSe 15454 mid-late genotypes produced significantly higher cane yield over all the tested zonal checks. Sucrose per cent varied significantly among mid-late genotypes. CoLk 15469 recorded significantly higher sucrose per cent (18.24) over Bo 91 zonal check (17.06). Recommended dose of fertilizer 125 per cent application improved the shoot population, NMC and cane yield significantly but there was no significant improvement observed in germination and sucrose per cent.

IMPORTANT OBSERVATIONS:

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

Sl. No.	Zone	Early genotypes	Mid-late genotypes	RDF levels
1	North Western	Co15024, Co 15027, CoPb 15212, CoLk 15205	CoS15233, CoS15232, CoLk15209	Majority of the centres reported significant influence of higher RDF on sugarcane growth, yield and quality.
2	Peninsular	CoN14073, Co14016, CoSnk14102		Significant influence of higher RDF was not found.
3	East Coast	CoV16356	--	No influence of higher RDF
4	North Central	CoP15436, CoSe15455	CoSe15455, CoLk15468	Significant effect of higher RDF was noticed.

AS- 73: Assessment of climate change impact on sugarcane productivity

The trial was initiated during 2018-19 and was allotted to the centres equipped with meteorological observatory. Daily meteorological data from various centres have been received and compiled for long term trend analysis. A comprehensive trend analysis in weather parameters across the zones has to be done to correlate the weather variability with sugarcane growth and yield. DSSAT model is being calibrated for assessing the impact of weather variability on sugarcane growth and yield in different sugarcane producing zones of the country. The trial is proposed to be closed as the weather data from various centres have been received. Weather trend analyses and its correlation with sugarcane growth and yield for different zones will be done at Lucknow and will be reported subsequently.

AS – 74: Evaluation of sugarcane varieties for drought tolerance

The trial was initiated during 2018-19 and was allotted to all the willing centres. During the year only 11 centres reported. Centre wise summary of findings for the year are given below:

NORTH WEST ZONE

1. FARIDKOT

Adequate moisture regime (IW/ CPE ratio 1.0) crop gave significantly higher cane yield than water stressed crop (IW/CPE ratio 0.3). The yield reduction varied from 4.5 percent (CoPb 91) to 34.5 percent (Co118). During the crop season there was about 629 mm rainfall and 509 mm of it was from July to September. Overall mid-late maturing varieties proved more resilient to water stress as compared to early maturing varieties.

2. KOTA

CoPk 05191 variety was found better with respect to number of tillers, plant height, millable canes, cane yield, juice extraction (%), brix (%), CCS (%), CCS yield(t/ha) and purity (%) that resulted in significantly higher net return over rest of varieties under early maturing group and CoH 9264 variety was found superior with respect to plant height, root dry weight & dry matter accumulation, cane diameter, cane length, and cane yield under mid-late maturing group. Irrigation scheduling at IW/CPE ratio 1.0 was found more profitable in sugarcane yield as compared to IW/CPE ratio 0.3.



3. LUCKNOW

Result revealed that, among the six varieties of sugarcane, CoPK 05191 produced the highest number of tillers (90 DAP), NMC, sugarcane yield, juice extraction percentage and CCS t ha⁻¹, which may be due to production of higher root dry weight, LAI and average cane weight. Minimum reduction in sugarcane yield (11.89%) due to moisture stress (IS 0.30) was recorded with variety CoPk 05191 followed by variety CoLk 11206 which was at par with CoLk 94184 (16.8%).

4. SHAHJAHANPUR

Experimental data showed that variety CoLk 94184 recorded significantly higher cane yield (93.30 t/ha) followed by CoSe 11453 with cane yield of 89.20 t/ha. IW/CPE ratio 1.0 produced significantly higher cane yield of 86.20 t/ha over that of IW/CPE ratio 0.3 (78.20 t/ha). CCS% was not affected significantly with different varieties and IW/CPE ratio.

5. UCHANI

Variety CoH 167 (102.8t/ha) and Co 0238 (101.7 t/ha) being at par recorded the highest cane yield while variety Co 0118 (76.3 t/ha) recorded significantly lowest cane yield. Variety Co 05011 (108.4 thousand/ha) recorded significantly higher number of NMC which was at par with Co 0238, CoH 160 and CoH 167. Higher moisture regimes recorded significantly higher number of tillers, NMC, cane weight and cane yield. Based on one year study it is concluded that varieties CoH 167 (mid late) and Co 0238 (early) are the best choice under drought conditions with highest yield as well as higher water productivity (cane yield produced per 1000 litres of irrigation water). During post monsoon, 52.5 cm irrigation water was applied in both the irrigation levels. Total (pre+post monsoon) irrigation water of 97.5 and 67.5 cm was applied at 1.0 and 0.3 IW/CPE irrigation schedule, respectively. Total (Irrigation+rainfall) water was calculated as 200.3 and 170.3 at 1.0 and 0.3 IW/CPE irrigation schedule, respectively.

PENINSULAR ZONE

6. PUNE

On the basis of results obtained from present investigation it can be concluded that, for securing maximum cane yield (118.33 t/ha), CCS yield (17.05 t/ha) and high crop performance, irrigate the crop at 1.0 IW/CPE ratio. With respect to genotypes/ variety, CoVSI 18121 gained higher NMC (0.72 lakh/ha) and cane yield (130.61 t/ha) followed by CoM 0265, VSI 8005 and VSI 12003. Regarding juice quality VSI 434 was a good performer. Moisture regime and varietal performance did not interact significantly, however there was average 30% reduction in cane yield across the varieties owing to drought stress.

7. SANKESHWAR

Irrigation scheduling IW/CPE ratio 1.0 was significantly

better for obtaining higher sugarcane yield compared to IW/CPE ratio 0.3. Among the cultivars mid-late cultivar CoSnk 09227 and early cultivar SNK 088789 performed better as compared to other cultivars. The higher cane yield was obtained with interaction of mid-late cultivar CoSnk 09227 with IW/CPE ratio 1.0. At IW/CPE ratio 0.3, cultivars viz., CoSnk09227 (mid-late) and SNK 088789 (early) performed better than rest of the cultivars.

8. KOLHAPUR

Irrigation scheduling at IW/CPE ratio 1.0 was significantly better for obtaining higher sugarcane yield compared to IW/CPE ratio 0.3. Among the mid late cultivars Co 86032 performed better over other cultivars. Irrigation scheduling at IW/CPE ratio 0.3 with mid late cultivar Co 86032 recorded significantly higher cane yield of (103.83 t/ha). The data on sugarcane juice quality indicated that IW/CPE ratio 1.0 recorded significantly superior quality parameters viz., brix, sucrose %, CCS % and CCS yield (11.50 t/ha) as compared to irrigation scheduling at IW/CPE ratio 0.3. Among early maturing varieties CoC 671 showed the highest drought tolerance with highest mean cane yield (82.17 t/ha) over different moisture regimes.

9. POWARKHEDA

The findings at the centre reveal no significant difference in cane growth and yield due to different moisture regimes across the varieties. However, Co 85004 in early group and CoJn 86-600 among mid-late varieties performed best under both wet and dry moisture regimes. Irrigation scheduling for wet and dry moisture regimes exerted no influence over juice quality parameters of different sugarcane varieties of early and mid-late maturity groups.

NORTH CENTRAL ZONE

10. PUSA

Irrigation regimes had non-significant impact on all the growth and cane yield parameters as the location received adequate and well distributed rainfall during the year. As per IW: CPE ratio none of the irrigation was scheduled at 1.00 and 0.30 IW: CPE ratio. The evaporation and rainfall during the cropping period were 701.9 and 1647 cm, respectively. The rainfall was also well distributed in 58 rainy days needs no extra irrigation to any treatment. However, CoP 2061, CoP 16437 and CoP 9437 gave higher productivity and sugar yield under Bihar condition.

EAST COAST ZONE

11. NAYAGARH

There was significant difference between two irrigation regimes i.e IW/CPE ratio 1.0 and IW/CPE ratio 0.3. The crop recorded higher NMC and cane yield with IW/CPE ratio 1.0 due to uniform availability of water and nutrients to the crop throughout the crop cycle. However with IW/CPE ratio 0.3, with very limited water supply, among early maturing varieties, CoOr 12346 recorded significantly higher growth and yield parameters compared



to other varieties viz., CoA 92081 and CoC 15336. Similarly among mid-late maturing varieties, CoOr 15346 with IW/CPE ratio 0.3 recorded significantly higher growth and yield parameters compared to other varieties CoOr 13346 and CoV 92102. So this is possibly due to better drought tolerant capacity of these two varieties compared to other varieties.

IMPORTANT OBSERVATIONS:

Moisture stress during pre-monsoon growth phase brought

Zone	Early maturing	Mid-late maturing
North West	CoPb 91, CoPk 05191, CoLk 94184, CoH 9264, CoH 167	Co 05011, CoSe 11453
Peninsular	CoVSI 18121, CoSNK 088789, CoC 671, Co 85004	Co 86032, CoSnk 09227, CoJn 86-600
North central	CoP 16437	CoP 2061, CoP 9437
East coast	CoOr 12346	CoOr 15346

AS 75: Precision nutrient management through rescheduling time of application for widely spaced sugarcane plant - ratoon system

The trial was initiated during 2020-21 and was allotted to all the centres. During the year (2020-21) 11centres reported the results. Centre wise summary of findings for the year are given below:

NORTH WEST ZONE

1. FARIDKOT

Although band placement of N and K was numerically better than broadcasting but statistically results were at par for cane yield, growth and yield contributing characters. Cane yield with five split applications of N and K at par with three splits was significantly better than six and seven splits. There was non-significant influence of band placement and broadcasting of nutrients as well as suppletion in more number of splits over juice quality indicators.

2. KOTA

Application of fertilizers by band placement method gave the maximum higher tillers at 180 DAP (141.55, 000/ha), cane length (236.65 cm), millable cane (92.0, 000/ha), cane weight (1010 g), cane yield (93.65 t/ha), quality parameters viz. brix (21.85%), sucrose (19.47%), CCS (13.46%) and CCS yield (12.65 t/ha) over application of fertilizer by broadcasting method. Application of RDN + RDK in seven splits (basal 10 % remaining at 45, 75, 90, 120, 150 and 180 DAP in equal split) gave significantly higher tillers at 180 DAP (139.6, 000/ha), cane length (219.83 cm), millable cane (89.13, 000/ha), cane weight (998.3 g), cane yield (93.83 t/ha), quality parameters viz. brix (21.83 %), sucrose (19.35 %), CCS (13.45 %) and CCS yield (12.97 t/ha) over application of RDN + RDK in five splits (basal 10% remaining at 45, 75, 90 and 120 DAP in equal split) and Recommended dose and schedule of nutrient application.

about significant reduction in cane yield across all the zones. The loss in yield ranged within 20 to 35% in different sugarcane growing zones.

Sugarcane varieties found resilient against moisture stress in different sugarcane growing zones are:

3. LUCKNOW

Band placement of N and K recorded significantly higher cane yield (100.9 t/ha) and commercial cane sugar (CCS) in plant (12.08 t/ha) as compared to broadcasting method. This method maintained similar order of performance in terms of other yield attributes with the result that band placement produced the highest cane diameter (2.6 cm), cane length (287 cm), and single cane weight (1.35 kg). Significantly higher NMC, single cane weight resulted higher cane and sugar yield under band placement. Six Splitting of N and K produced higher cane yield (100.6 t/ha) being at par with five (S1), seven (S3) and two splitting (S4). Splitting of N and K did not affect significantly yield and other attributes. Significantly highest sucrose % was recorded with two (S4) and five (S1) splitting as compared to six (S2) and seven (S3) splitting of N and K.

4. SHAHJAHNPUR

Band placement of fertilizer produced significantly higher cane yield of 106.10 t/ha than that of broadcasting with cane yield of 91.60 t/ha. In case of time of fertilizer application significantly higher cane yield (108.30 t/ha) was obtained with RDN+RDK in seven splits (basal 10% remaining at 45,75,90,120,150 and 180 DAP in equal splits) and it was at par with RDN+RDK in six splits (10% Basal and remaining at 45,75,90,120 and 150 DAP) in equal splits with cane yield of 105.0 t/ha). CCS% was similar under different methods and time of fertilizer application.

5. UCHANI

Band placement of fertilizer was found to be superior over broadcasting of fertilizer whereas split application improved yield and growth parameters. Significantly higher number of tillers (129.61 thousand/ha) and NMC (109.3 thousand/ha) were recorded in band placement of fertilizers as compared to broadcasting. Potassium when applied in seven splits along with RDN resulted in



significantly higher tillers (130.4 thousand/ha) and NMC (111 thousand/ha) which was at par with six splits. Cane yield (85.3 t/ha) and cane girth (2.542 cm) was significantly higher under band placement. Similarly, cane yield (86.33 t/ha), cane height (229.9 cm) and cane girth (2.573 cm) was highest when fertilizer (N & K) were applied in seven splits, which was statistically at par with six splits application of fertilizer (N&K).

PENINSULAR ZONE

6. SANKESHWAR

Higher cane yield was recorded for interactions. Among the interaction M2S2 i.e., band application of RDN+RDK at six splits (134.9 t/ha) recorded significantly higher cane yield as compared to other interactions. This was due to higher NMC and single cane weight in this interaction. The next best interaction was M1S2 (131.8 t/ha) which was at par with each other. Significantly lower cane yield was with M1S4 (107.2 t/ha). The quality parameters viz., brix, pol and purity did not differ significantly due to interaction effects. However, CCS yield (t/ha) differed significantly among the interaction effects which followed same trend as that of cane yield.

7. KOLHAPUR

The band placement method of fertilizer application was significantly superior over broadcasting method of fertilizer application for growth and yield attributing characters. However, as far time of fertilizer application (T), application in seven equal splits (basal 10% remaining at 45, 75, 90, 120, 150 and 180 DAP) recorded significantly higher cane, CCS yield and more B:C ratio than rest of the treatments.

8. POWARKHEDA

Results revealed that band placement of nutrients recorded significantly higher cane yield (147.69 t/ha) over broadcasting method (119.59 t/ha). Among schedules of application, splitting of RDN +RDK in seven splits produced significantly higher cane yield (136.53 t/ha) as compared to five splitting (129.21t/ha) but was at par with conventional four splits. Juice quality was not found to be influenced with the methods or number of splits of nutrient application.

NORTH CENTRAL ZONE

9. PUSA

Band placement of N and K fertilizer recorded higher plant population (1, 67, 900/ ha), millable canes (1, 18,000/ ha) and cane yield (86.7 t/ha). Cane yield obtained under

broadcasting was 73.9 t/ha. Similarly, significantly higher N, P and K uptake by sugarcane was noticed due to the band placement of nitrogen and potassic fertilizers. There was no influence of treatments on the juice quality parameters.

10. SEORAH

Significantly higher cane yield (104.66 t/ha) was observed with band placement fertilizer application method over broadcasting method of fertilizer application. Split doses of N + K produced significantly higher cane yield over RDF and scheduling of nutrient applications. Sucrose percent was not affected significantly by different methods of fertilizer application.

EAST COAST ZONE

11. NAYAGARH

There was significant difference between method of nutrient application as well as among schedule of nutrient application. For all the growth and yield attributes band placement of fertilizers was found to be significantly better than broadcasting method of fertilizer application which ultimately resulted in higher yield. Among schedule of nutrient applications, higher NMC (91.22'000/ha) and cane yield (102.41 t/ha) were recorded with application of RDN +RDK in six splits which is at par with application of RDN + RDK in five splits (NMC 88.37'000/ha and cane yield 100.67 t/ha).

Salient findings:

Results of 11 AICRP (S) centres allocated in four different zones revealed that method of application of nitrogen and potassium fertilizers through band placement recorded higher number of millable canes, single cane weight, cane yield and CCS yield in all zones over broad casting method of nitrogen and potassium fertilizers application. However, the significant variation in number of millable canes and cane yield was observed only in North West zone and East Coast zone of the country. Splitting of nitrogen and potassium fertilizers as RDN + RDK in seven splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits) recorded the higher number of millable canes, cane yield and CCS yield in all zones of country except East Coast zone. However, significant response for number of millable canes and cane yield of sugarcane was recorded in North Central zone and East Coast zone due to splitting of nitrogen and potassium fertilizers in seven split (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits) (Table 1.1, 1.2 & 1.3).



Table 1.1/AS 75: Effect of nitrogen and potassium application on NMC (000/ha) of sugarcane

<i>Method of N & K application</i>	North West Zone	Peninsular Zone	North Central Zone	East Coast Zone
Broadcasting	95.3	101.8	96.8	85.2
Band placement	102.5	115.5	112.3	87.5
SE (d)	2.26	7.91	5.15	0.36
LSD at 5%	6.29	NS	NS	2.20
CV (%)	3.62	8.92	4.92	-
Splitting of N & K fertilizer				
RDN + RDK in five splits (Basal 10% remaining at 45, 75, 90 and 120 DAP in equal splits)	98.7	104.9	105.1	88.4
RDN + RDK in six splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits)	99.2	110.5	109.2	91.2
RDN + RDK in seven splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits)	99.3	111.3	112.5	83.9
Half of total N and full dose of P & K at planting and rest of N at 45 and 120 DAP in equal quantity	94.4	107.8	91.4	82.0
SE (d)	2.36	2.90	2.15	0.80
LSD at 5%	NS	NS	6.83	2.48
CV (%)	3.82	3.26	2.05	-

Table 1.2/AS 75: Effect of nitrogen and potassium application on single cane weight (g) of sugarcane

<i>Method of N & K application</i>	North West Zone	Peninsular Zone	East Coast Zone
Broadcasting	1071	1350	1120
Band placement	1142	1420	1130
SE (d)	29.6	20.0	1
LSD at 5%	NS	NS	5
CV (%)	3.27	1.44	-
Splitting of N & K fertilizer			
RDN + RDK in five splits (Basal 10% remaining at 45, 75, 90 and 120 DAP in equal splits)	1030	1315	1140
RDN + RDK in six splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits)	1038	1513	1130
RDN + RDK in seven splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits)	1082	1409	1120
Half of total N and full dose of P & K at planting and rest of N at 45 and 120 DAP in equal quantity	981	1645	1120
SE (d)	61.4	353.2	4
LSD at 5%	NS	NS	13
CV (%)	7.28	24.0	-



Table 1.3/AS 75: Effect of nitrogen and potassium application on cane yield (t/ha) of sugarcane

Method of N & K application	North West Zone	Peninsular Zone	North Central Zone	East Coast Zone
Broadcasting	91.5	117.3	79.9	96.0
Band placement	98.6	134.9	95.7	99.2
SE (d)	2.31	6.27	3.03	0.48
LSD at 5%	6.42	NS	NS	2.95
CV (%)	3.84	6.09	3.45	-
Splitting of N & K fertilizer				
RDN + RDK in five splits (Basal 10% remaining at 45, 75, 90 and 120 DAP in equal splits)	94.3	119.4	88.7	100.7
RDN + RDK in six splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits)	95.5	129.9	90.7	102.4
RDN + RDK in seven splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits)	96.0	131.8	93.7	94.9
Half of total N and full dose of P & K at planting and rest of N at 45 and 120 DAP in equal quantity	90.1	123.3	87.8	92.5
SE (d)	4.24	5.55	1.42	0.77
LSD at 5%	NS	NS	4.52	2.36
CV (%)	7.14	5.39	1.62	-

Table 1.4/AS 75: Effect of nitrogen and potassium application on CCS yield (t/ha) of sugarcane

Method of N & K application	North West Zone	Peninsular Zone	North Central Zone	East Coast Zone
Broadcasting	11.6	14.0	9.3	11.4
Band placement	12.7	15.2	10.9	12.1
SE (d)	0.37	0.36	0.29	0.06
LSD at 5%	NS	NS	NS	0.37
CV (%)	3.77	2.43	9.9	-
Splitting of N & K fertilizer				
RDN + RDK in five splits (Basal 10% remaining at 45, 75, 90 and 120 DAP in equal splits)	11.2	14.0	10.1	12.1
RDN + RDK in six splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits)	12.2	15.1	10.6	12.3
RDN + RDK in seven splits (Basal 10% remaining at 45, 75, 90, 120 and 150 DAP in equal splits)	12.7	15.4	10.9	11.4
Half of total N and full dose of P & K at planting and rest of N at 45 and 120 DAP in equal quantity	10.8	14.2	8.90	11.3
SE (d)	0.67	1.18	0.40	0.21
LSD at 5%	NS	NS	1.20	0.65
CV (%)	6.98	8.06	9.60	-

IMPORTANT OBSERVATIONS:

- Post emergence band placement of nitrogen and potassium resulted in higher cane yield and CCS (t/ha) as compared to that with broadcasting at most of the centres across the zones.
- In subtropical region comprising North Central and North Western zones split application of nitrogen and potassium up to 150 days after planting brought about significant improvement in cane yield.
- For the centres located in Peninsular and East Coast zones split application of nitrogen and potassium up to 180 days after planting resulted in higher cane yield over conventional splitting up to 95 days after planting.



Summary of Crop Production

- Elite genotypes belonging to early and mid-late maturity groups were found to perform well at wider spacing of 120 cm in sub-tropical region and at 150 cm in Peninsular and East-Coast zones. Response to higher (125%) recommended dose of fertilizers was conspicuous across the zones.
- Long term weather data indicated continuous reduction in rainfall in the North- West zone combined with conspicuous rise in minimum temperature.
- Water efficient varieties belonging to early and mid-late maturity groups were identified for different zones.
- Post emergence band placement of nitrogen and potassium resulted in higher cane yield and CCS (t/ha) as compared to that with broadcasting at most of the centres across the zones.
- In subtropical region comprising North Central and North Western zones, split application of nitrogen and potassium up to 150 days after planting brought about significant improvement in cane yield.
- For the centres located in Peninsular and East Coast zones, split application of nitrogen and potassium up to 180 days after planting resulted in higher cane yield over conventional splitting up to 95 days after planting.

Annexure I

Details of Experiments allotted and conducted by different Centres during 2019-20

Sl. No.	Centre	Trial allotted				Trial reported			
1	Faridkot*	AS72	AS73	AS74	AS75	AS72	Centres have submitted the weather data and trend analyses is to be done.	AS74	AS75
2	Kota*	AS72	AS73	AS74	AS75	AS72		AS74	AS75
3	Lucknow	AS72	AS73	AS74	AS75	AS72		AS74	AS75
4	Shahjahanpur	AS72	AS73	AS74	AS75	AS72		AS74	AS75
5	Uchani	AS72	AS73	AS74	AS75	AS72		AS74	AS75
6	Coimbatore	AS72	AS73	AS74	AS75	AS72		-	-
7	Kolhapur	AS72	AS73	AS74	AS75	AS72		-	AS75
8	Pune	AS72	AS73	AS74	AS75	AS72		AS74	-
9	Sankeshwar	AS72	AS73	AS74	AS75	AS72		AS74	AS75
10	Nayagarh	AS72	AS73	AS74	AS75	AS72		AS74	AS75
11	Pusa	AS72	AS73	AS74	AS75	AS72		AS74	AS75
12	Seorahi	AS72	AS73	AS74	AS75	AS72		AS74	AS75
13	Powarkheda	AS72	AS73	AS74	AS75	AS72		AS74	AS75



PLANT PATHOLOGY

In Plant Pathology discipline, sixteen centers participated in different program during 2020-2021. The list of the projects conducted in discipline Plant Pathology are summarized below –

PP 14: Identification of pathotypes in red rot pathogen

In this project, 12 centers participated and a total of 97 isolates along with respective designated pathotypes of their zone were tested on nineteen host differentials. More number of isolates were obtained from the popular sugarcane variety Co 0238 and significant number of isolates were also obtained from other sugarcane varieties like Co 89003, CoJ 85, CoS 8436, Co 62175 and CoC 24. In North west zone, Lucknow center reported that the virulence pattern of Co 0238 isolates did not match with the designated pathotypes namely CF07, CF08 and CF09, clearly indicating the emergence of specific virulence of Co 0238 isolates on its host which is different from the existing pathotypes of this zone. Shahjahanpurcenter also reported that the isolates of Cf0238 were found as an emergence of new strain red rot pathogen. On contrary, Kapurthala center reported that Punjab state is still free from any new emerging isolate of red rot pathogen. However, it is witnessing with breakdown of resistance in Co 0238 and needs further confirmation of existing pathotype of *C. falcatum*. Karnal center reported that the isolate Cf89003 (Karnal) was too virulent and the results suggests the possible emergence of new pathotype. In north central zone, Seorahi center reported that Co 0238 isolates have specific virulence that is capable of knocking down the popular variety Co 0238. Based on findings and virulence pattern of new red rot pathotype, the new virulent pathotype caused severe red rot epidemics has been designated as CF13 and will be used for red rot screening in North West and North Central zones, respectively in place of CF09 and Cf07. In East coast zone, the new isolates tested were reported to be similar to the existing pathotype. In Peninsular zone, the centers reported that least variation of local isolates from designated pathotypes.

PP17: Evaluation of zonal varieties for Red rot, Smut, Wilt, YLD, Rust and Pokkahboeng

In ZVT, 15 centers carried out red rot screening, 13 centers done smut screening, 7 centers have screened the clones for wilt resistance, 15 centers screened clones for YLD, 4 centers done rust screening and 8 centers involved in screening clones for pokkah boeng. The participating centers identified good number of R/MR entries to all these diseases and the reactions of entries are presented in the combined tables (Table 1, 2, 3, 4, 5).

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

Fifteen centers carried out survey for occurrence and intensity of sugarcane diseases in their location/state. In

North West zone except Pantnagar all other centers recorded red rot incidence, while smut and wilt were recorded by most of the centers. In Uttar Pradesh severe red rot was noticed in Co 0238 (70-100%) in few locations and the varieties CoS 8436, CoPk 05191 and CoS 08279 were also affected by red rot up to 2%. Kapurthala center recorded traces to 15% of red rot in Co 89003, CoJ 64, CoJ 85, Co 89003 and CoPb 91 and up to 20% smut on Co 0238, Co 89003 and CoPb 93. Pokkah boeng disease was observed on Co 0238, CoJ 85, Co 118, CoPb 91, CoPb 92 and CoPb93 from traces to 25%. Uchanicentre reported red rot at 5- 23% on varieties like Co 89009, CoJ 85, Co 0238, CoS 8436. Incidence of smut up to 55 per cent was observed in Co 0118, Co 0238, Co 05011, Co 89003, CoH 119 and CoH 167. Wilt was noticed in Co 89003, Co 05011 and Co 15023. Karnal centre reported red rot incidence up to 30% on variety Co 89003, and mild to severe incidences of pokkah boeng. Pant nagar centre reported PB, smut and GSD on Co 0118, Co 0238, Co 0239, CoPant 99214 and CoH 0160.

In North central zone the Pusa centre observed 5-20% of wilt in Co 0118 and red rot up to 5%. The variety CoP 2061 was affected with wilt and PBD up to 5%. The variety Co 0238 was found affected with YL (traces to 2%), red rot (5-10%) and wilt (5-25%). The variety BO 154 was affected with PB upto 5% and CoV 92102 was affected with YL upto 2%, PB 10% and mosaic upto 5%. Motipur center reported that the variety Co 0238 was noticed with RR at several locations of Uttar Pradesh to the tune of 15% to 80%. Incidence of smut was observed in Co 0238, CoSe 92423, CoS 88230 and CoS 91269 and PB was observed as major disease in most of the location surveyed with the variety Co 0238. The Seorahi centre reported the red rot incidence from trace to 89% on the cv Co 0238 and 4- 5% on CoS 08272 and CoS 08279. Wilt incidence also noticed from 4 to 87% on the variety Co 0238. Buralikson reported traces of red rot and wilt on Co 997 and PB on CoBln 9104.

In East coast zone Anakapalle recorded red rot incidences on Co 62175, CoV 89101 and 87V 94. Smut incidence (5-20%) was observed in almost all the areas surveyed in Andhra Pradesh in the variety CoA 92081. In this zone GSD is increasing in CoA 14321, CoA 7602, 2000A 56, 2007A 81, Co 7805 and CoA 92081. Cuddalore centre reported 1-35% red rot in varieties viz., Co(SC)Si 6, CoC 23, CoC 24, CoV 09356 and PI 001401 1 to 35 %, upto 5% smut in CoC 25 and PI 001401.

In Peninsular zone red rot incidence was recorded from traces to 5% in South Gujarat regions in the Co 0238, Co 06030, Co 16002, Co 86032, Co 97009, Co 985117, CoC 671, CoM 0265, CoSi 95071, CoVSI 08005 and MS 10001 and upto 11% smut in Co 86002, CoSi 95071 and Co 97009. The brown rust was severe in Western and Central Maharashtra in CoM 0265 and Co 86032. YL is increasing in Co 86032, VSI 08005 and CoM 0265 and brown spot disease was observed mostly in CoM 0265 in Maharashtra



regions. In Kerala, PB was recorded in mild to moderate form in some varieties. Coimbatore centre reported severe incidences of red rot in the cv Co 86027 and trace to 5% red rot in the cv CoM0265. The varieties Co 0212, Co 06022, Co 11015, PI 1110 and CoV 09356 exhibited severe crop losses due to PB in different districts. There were severe outbreaks of PB in different varieties and mealy bug infestation in the spindle was found to aggravate the disease severity.

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

Eleven centers involved in assessing the red rot resistance of *Saccharum sp.* and elite genotypes. In Lucknow, only one genotype ISH 516 was rated as R and 16 as MR against CF08 and CF09. In Shahjahanpur out of 25 genotypes, six near commercial hybrids viz., Co 09022, Co 12029, Co 14034, Co 15023, Co 15026, Co 15027 also tested against red rot and was found MR. Of the 24 ISH genotypes tested, one genotype ISH 516 was rated as R against both the pathotypes CF08 and CF09. Among 27 genotypes screened at Kapurthalacentre 12 ISH clones were found MR against both CF08 and CF09. Uchani centre identified 8 resistant genotypes among 25 clones, while Karnal identified 2 R clones and 6 MR clones. In North central zone, Pusa identified five clones showing MR reactions. In Seorahi centre, 7 genotypes were rated as R, 5 genotypes were rated as MR. In East coast zone Cuddalore centre identified 6 R and 11 MR clones, while Anakapalle reported 5 R and 2 MR clones. In Peninsular zone Navsari reported that out of the 28 ISH genotypes screened 2 clones viz., ISH 564 and ISH 585 were identified as R and 15 clones were rated as MR against both the pathotypes. At Coimbatore, out of 30 clones 20 were identified as R by plug method and 25 as R.

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

Nine centers involved in screening of entries for PB resistance and identified many R/MR genotypes. Studies on epidemiology and its management in six centres showed that PB incidence was highly correlated with rainfall, temperature and RH. Correlation coefficient between disease severity and weather variables was significant. Six centres involved in PB management experiment and the results showed that sett treatment with carbendazim + foliar spray with carbendazim @ 0.1% at 15 days interval was found effective for better germination and PB management.

PP32: Management of brown spot disease of sugarcane

The experiment was conducted at Pune centre and it was found that 3 sprays of fungicides Tebuconazole and Propiconazole @ 0.1% at 15 days interval after initiation of disease were found effective to control brown spot.

PP 33: Management of yellow leaf through meristem culture

Seven centers participated in this program. Shahjahanpur centre transplanted a total of 2280 hardened seedlings of CoS 08272 raised through meristem culture in the field for the production of breeder seed and observed for YL disease incidence. In that 95% of seedlings survived after transplanting in field. Uchani centre developed seedlings of Co 0238 and CoH 160 varieties through tissue culture and distributed to farmers. Anakapalle center reported that yield is high in TC plants (68.33 t/ha) compared to CP (56.88 t/ha) plants. Mosaic incidence was found to be high in CP (7.2%) plants compared to TC plants (4.7%). Cuddalore center reported that sugarcane raised from the tissue culture seedlings was superior to conventional two budded sett planting in all the plant growth characters observed in both the varieties Co 86032 and CoC 25. Coimbatore centre conducted field trial with healthy and disease-affected planting materials of three popular cvs Co 86032, Co 0238 and Co 11015 and assessed impact of YL on cane growth and yield under field conditions. Impact of YL on various morpho-physiological and yield parameters were also recorded in virus-free, apparently healthy and symptomatic plants of the cv Co 86032.

PP 34: Efficient delivery of fungicides and other agro inputs to manage major fungal diseases in sugarcane

The experiment on combination of sett treatment with fungicides for red rot management was evaluated in six centres. In Shahjahanpur, Seorahi, Anakapalle and Cuddalore centres, it was found that Sett treatment using STD with fungicide Thiophanate methyl (0.1%) followed by soil drenching with Thiophanate methyl (0.1%) at 45th & 90th day was most effective against red rot. At Coimbatore, treating setts in STD with the combination of thiophanate methyl and *P. alvei* was found to be significantly superior followed by combination of *Paenibacillus alvei* and *Trichoderma harzianum* in protecting the setts from soil borne inoculum and improving plant survival. For management of smut, Seorahi and Cuddalore centres observed that sett treatment in STD with propiconazole (Tilt-25Ec) @ 0.4ml/ lit (100 ppm) + Spray by 45th and 90th day (T2) was found to be the best. Seorahi and Anakapalle centres observed that sett treatment in STD with fungicide Propiconazole + Soil drenching with Carbendazim at 45th and 90th days was very effective for wilt management. Anakapalle centre found that treatment of single node setts with STD using mixture of Urea – 0.5g /L + ZnSO4 – 0.5g/L + FeSO4 – 0.5g/L+ carbendazim-0.5g/L+Fipronil -0.5ml/L enhanced sett germination and seedling vigour in sugarcane variety 2009A107.



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

SL No.	Genotype	Red rot												Smut				Wilt		YLD		
		Lucknow				Kaparthala				Uchani				Lucknow		Kaparthala		Uchani				
		Plug		Nodal		Plug		Nodal		Plug		Nodal		Plug		Nodal		Lucknow		Kaparthala		
		CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	Lucknow	Kaparthala	Lucknow	Kaparthala	
Initial Varietal Trial (Early)																						
1	CoLk 17201	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	MR
2	CoLk 17202	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	R	MS
3	CoLk 17203	MR	MR	R	R	MS	MS	S	S	MR	MR	R	R	MR	MR	R	R	MS	MS	-	MS	MS
4	CoPant 17221	S	S	S	S	S	S	S	S	MS	MS	R	R	MS	MS	R	R	MS	MS	-	MS	MS
5	CoPb 17211	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	R	MS
6	CoPb 17212	MR	MR	R	R	MS	MS	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	W	R	MS
7	CoS 17231	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	S
Initial Varietal Trial (Midlate)																						
1	Co 17018	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	R	S
2	CoH 17261	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MS	MR
3	CoH 17262	S	S	S	S	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	MR
4	CoLk 17204	MR	MR	R	R	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	-	R	S
5	CoLk 17205	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	MS
6	CoPant 17223	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	R	S
7	CoPant 17224	HS	HS	S	S	HS	HS	S	S	S	S	S	S	S	S	S	S	MR	MR	-	MR	MR
8	CoPb 17213	S	S	S	S	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	-	MR	MS
9	CoPb 17214	MS	MS	R	R	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	W	-	MS
10	CoPb 17215	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	-	MS
11	CoS 17233	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	R	S
12	CoS 17234	MR	MR	R	R	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	W	R	S
13	CoS 17235	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	R	S
14	CoS 17236	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	MR
15	CoS 17237	MR	MR	R	R	HS	HS	S	S	HS	HS	S	S	HS	HS	S	S	MR	MR	W	MR	MR
Advanced Varietal Trial (Early)-I Plant																						
1	Co 15025	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	MS	MR
2	Co 16029	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	MR
3	CoLk 14201	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	MR
4	CoLk 16201	R	R	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	MR
5	CoLk 16202	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MS	MS
6	CoPb 16181	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	MR
Advanced Varietal Trial (Early)-II Plant																						
1	Co 15023	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MS	MR
2	Co 15024	MS	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	MR	MR
3	Co 15027	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	W	R	MR
4	CoLk 15201	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	-	MR	S



Sl. No.	Genotype	Red rot												Smut			Wilt			YLD		
		Lucknow				Kapurthala				Uchani				Lucknow		Kapurthala		Uchani		Lucknow	Kapurthala	Uchani
		Plug		Nodal		Plug		Nodal		Plug		Nodal		Lucknow	Kapurthala	Uchani	Lucknow	Kapurthala	Uchani			
		CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09									
5	CoLk 15205	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	MR	MR	R	R	MR	MR	
6	CoPb 15212	MS	MS	R	R	MR	MS	R	R	MR	MR	R	R	R	R	MR	MR	R	R	MR	MR	
Advanced Varietal Trial (Mid late)-I Plant																						
1	Co 16030	MS	MS	R	R	MR	MR	R	R	MR	MS	R	R	R	R	R	R	R	R	R	MS	
2	CoLk 16203	MR	MR	R	R	MR	MR	R	R	MR	MS	R	R	R	R	R	R	R	R	R	MS	
3	CoLk 16204	R	R	R	R	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MR	
4	CoS 16232	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MR	
5	CoS 16233	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MR	
Advanced Varietal Trial (Mid late)-II Plant																						
1	Co 15026	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MR	
2	CoLk 15206	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MS	
3	CoLk 15207	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MS	
4	CoLk 15209	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MS	
5	CoPb 15213	MR	MR	R	R	MR	MR	R	R	MR	MS	R	R	R	R	R	R	R	R	R	MS	
6	CoS 15232	MR	MR	R	R	MR	MS	R	R	MR	MS	R	R	R	R	R	R	R	R	R	MS	
7	CoS 15233	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MS	
Checks																						
1	CoJ 64	HS	S	-	-	HS	HS	S	S	HS	HS	S	S	S	S	S	S	S	S	S	MS	
2	CoS 767	S	S	-	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	MS	
3	Co 1158	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4	CoLk 7701	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	Co 0238	-	-	-	-	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MS	
6	Co 05009	-	-	-	-	MR	MR	R	R	MR	MS	R	R	R	R	R	R	R	R	R	MS	
7	Co 05011	-	-	-	-	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	R	R	MS	
8	CoPant 97222	-	-	-	-	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
9	Co 740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	Co 62175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11	NCo 310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12	Katha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
13	Co 7717	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	
14	Co 89003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	



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

Sl. No.	Genotype	Red rot												Smut		Wilt		YLD							
		Shahjahanpur			Pantnagar			Karnal			Shahjahanpur		Pantnagar		Karnal										
		Plug	Nodal	CF09	CF08	CF09	CF08	CF09	CF08	Plug	Nodal	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09	CF08	CF09			
Initial Varietal Trial (Early)																									
1	CoLk 17201	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	
2	CoLk 17202	MR	MR	R	R	MR	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R
3	CoLk 17203	S	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	MR
4	CoPant 17221	MS	MS	R	R	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	MS
5	CoPb 17211	MS	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R
6	CoPb 17212	S	MS	S	R	Not-Planted				HS	S	S	S	HS	S	S	S	NP	NP	HS	HS	MR	NP	-	
7	CoS 17231	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	-
Initial Varietal Trial (Midlate)																									
1	Co 17018	MR	MR	R	R	MS	MR	R	R	MR	MR	R	R	MR	MR	R	R	MS	MS	S	S	MR	MR	R	MR
2	CoH 17261	MR	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R
3	CoH 17262	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	MR
4	CoLk 17204	MR	MR	R	R	MS	MR	R	R	MR	MR	R	R	MS	MR	R	R	MS	MR	S	S	MR	MR	R	MS
5	CoLk 17205	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	S	S	MR	MR	R	MS
6	CoPant 17223	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	S	S	MR	MR	R	MR
7	CoPant 17224	S	S	S	R	MR	MR	R	R	S	HS	S	S	HS	S	S	S	MR	MR	S	S	MR	MR	R	R
8	CoPb 17213	MR	MS	R	R	MR	MR	R	R	MS	MR	R	R	MR	MR	R	R	MR	MR	S	S	MR	MR	R	MR
9	CoPb 17214	MR	MS	R	R	MR	MR	R	R	MS	MR	R	R	MR	MR	R	R	MR	MR	S	S	MR	MR	R	MR
10	CoPb 17215	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	S	S	MR	MR	R	MR
11	CoS 17233	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	S	S	MR	MR	R	S
12	CoS 17234	MR	MR	R	R	MS	MS	R	R	MR	MR	R	R	MS	MR	R	R	MR	MR	S	S	MR	MR	R	MS
13	CoS 17235	MR	MR	R	R	MS	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	S	S	MR	MR	R	MR
14	CoS 17236	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	S	S	MR	MR	R	MR
15	CoS 17237	HS	HS	S	S	MS	MS	R	R	HS	HS	R	R	HS	HS	S	S	MS	MS	S	S	MR	MR	R	MS
Advanced Varietal Trial (Early)-I Plant																									
1	Co 15025	MR	MR	R	R	R	R	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	MR
2	Co 16029	R	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	HS	HS	MR	MR	R	MR
3	CoLk 14201	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	-	-	-	MR	MR	R	R	MR	MR	R	-
4	CoLk 16201	MR	MR	R	R	MS	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	S	MS	MR	MR	R	MS
5	CoLk 16202	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	MR	MR	MR	R	MR
6	CoPb 16181	MS	MR	R	R	MS	MS	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	HS	MS	MR	MR	R	MS
Advanced Varietal Trial (Early)-II Plant																									
1	Co 15023	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	MR
2	Co 15024	MS	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	MR	MR	R	MR



Sl. No.	Genotype	Red rot												Smut		Wilt		YLD		
		Shahjahanpur			Pantnagar			Karnal			Shahjahanpur		Pantnagar		Shahjahanpur	Pantnagar	Karnal			
		Plug	CF08	CF09	Plug	CF08	CF09	Plug	CF08	CF09	Plug	CF08	CF09	Shahjahanpur	Pantnagar	Shahjahanpur	Pantnagar	Karnal		
3	Co 15027	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	R		
4	CoLk 15201	MR	MS	R	MS	R	R	R	R	R	R	R	R	R	MS	R	MS	R		
5	CoLk 15205	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	R	R	R	MR		
6	CoPb 15212	MS	MS	R	MR	R	R	R	R	R	R	R	R	R	MR	R	R	R		
Advanced Varietal Trial (Mid late)-I Plant																				
1	Co 16030	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	MR	R	R	R		
2	CoLk 16203	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	MS	R	R	R		
3	CoLk 16204	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	S	R	R	MR		
4	Cos 16232	MR	R	R	MR	R	R	R	R	R	R	R	R	R	MS	R	R	R		
5	CoS 16233	MR	R	R	MR	R	R	R	R	R	R	R	R	R	MR	R	R	R		
Advanced Varietal Trial (Mid late)-II Plant																				
1	Co 15026	MR	R	R	MS	R	R	R	R	R	R	R	R	R	MS	S	R	MR		
2	CoLk 15206	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	MR	R	R	MR		
3	CoLk 15207	MR	R	R	MR	R	R	R	R	R	R	R	R	R	MS	R	R	MR		
4	CoLk 15209	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	S	HS	MR	R		
5	CoPb 15213	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	MR	HS	R	MS		
6	CoS 15232	MR	MR	R	MS	R	R	R	R	R	R	R	R	R	R	MS	R	MR		
7	CoS 15233	MR	R	R	MR	R	R	R	R	R	R	R	R	R	MR	MS	R	MS		
Checks																				
1	Co 0238	MR	MR	R	MS	R	R	R	R	R	R	R	R	R	MS	HS	R	R		
2	Co 05009	MR	MR	R	MR	R	R	R	R	R	R	R	R	R	R	MS	MR	R		
3	CoJ 64	HS	HS	S	S	R	R	R	R	S	MR	S	R	MR	MR	R	R	MS		
4	CoPant 97222	MR	MR	R	MS	R	R	R	R	MS	MR	MR	R	R	MS	MS	R	MS		
5	Co 05011	MR	MR	R	MS	R	R	R	R	MR	MR	R	R	R	S	MR	MS	R		
6	CoS 767	HS	HS	S	S	R	R	R	R	R	MR	MR	R	R	MR	MR	R	MS		
7	Co 1158	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-		
8	CoPant 84211	S	R	MR	R	-	-	-	-	-	-	-	-	-	-	-	-	MR		
9	CoS 8436	MR	R	MR	R	-	-	-	-	-	-	-	-	-	-	-	-	R		



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

Sl. No	Genotypes	Red rot												Smut			Wilt			YLD													
		Motipur				Seorahi				Pusa				Motipur			Pusa			Motipur			Seorahi										
		Plug		Nodal		Plug		Nodal		Plug		Nodal		Plug		Nodal		Motipur			Pusa			Motipur			Seorahi						
		CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08				
IVT (Early)																																	
1	CoBln 17501	MR	MR	R	R	MR	MR	R	R	MR	MR	S	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	MS	MS	R			
2	CoP 17436	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	Y	R	R			
3	CoP 17437	MS	MS	S	S	MR	MR	R	R	MR	MR	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	-	MS	R			
4	CoP 17438	MR	MR	R	R	MR	MR	R	R	MS	MR	S	S	-	-	-	-	-	-	-	-	-	-	-	-	-	MR	-	MS	R			
5	CoP 17440	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	Y	MR	R			
6	CoP 17441	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	-	MR	R			
7	CoSe 16454	MR	MR	R	R	MR	MR	R	R	MS	MR	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	-	MR	R			
8	CoSe 17451	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	Y	MR	R			
IVT (Mid late)																																	
1	CoBln 17502	S	S	S	S	MS	MS	S	S	MS	MS	S	R	R	MS	MS	S	S	S	S	S	S	S	S	S	MR	MR	R	R	MS			
2	CoP 17444	MS	MS	S	S	MR	MR	R	R	MS	MS	S	S	-	-	-	-	-	-	-	-	-	-	-	-	-	R	Y	R	R			
3	CoP 17446	MR	MR	R	R	MR	MR	R	R	R	R	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	-	MR	R	R		
4	CoSe 16455	MS	MS	S	S	MR	MR	R	R	MR	MR	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	Y	MR	R	MR		
5	CoSe 16456	MR	MR	R	R	MR	MR	R	R	MR	MR	R	R	R	MR	MR	R	R	R	R	R	R	R	R	R	R	MR	-	MR	R	R		
6	CoSe 17452	MS	MS	R	R	MR	MR	R	R	S	MS	S	R	R	-	-	-	-	-	-	-	-	-	-	-	-	R	-	MR	R	R		
AVT (Early) I Plant																																	
1	CoLk 16466	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	MS	MR	S	R	MR	MR	S	MR	MR	MR	MR	MR	S	-	-	MR	-		
2	CoLk 16468	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	MR	R	R	R	MR	MR	R	MR	MR	MR	MR	MR	-	-	-	-	MR	-	
3	CoP 16437	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	MR	MR	R	R	MR	MR	R	MR	MR	MR	MR	MR	-	-	-	-	R	-	
4	CoP 16438	MR	MR	R	R	MS	MR	R	R	-	-	-	-	-	-	-	-	-	MR	MS	MR	MR	MR	MR	MR	MR	-	-	-	-	R	-	
5	CoSe 16451	MS	MS	S	S	MR	MR	R	R	-	-	-	-	-	-	-	-	-	MR	MR	R	MR	MR	MR	MR	MR	-	-	-	-	R	-	
AVT (Early) II Plant																																	
1	CoLk 15466	MR	MR	R	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	CoLk 15467	MR	MR	R	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	CoP 15436	MR	MR	R	R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	CoSe 15452	MR	MR	R	R	-	-	-	-	-	-	-	-	-	MS	MS	S	S	MR	MR	-	-	-	-	-	-	-	-	-	-	-	-	-
5	CoSe 15455	MR	MR	R	R	-	-	-	-	-	-	-	-	-	MR	MS	R	S	MR	MR	-	-	-	-	-	-	-	-	-	-	-	-	-
AVT (I-Plant Mid Late)																																	
1	CoBln 16502	MR	MR	R	R	MS	MS	R	R	-	-	-	-	-	MR	MR	R	R	MR	MR	S	R	R	R	R	R	-	-	-	-	R	-	
2	CoLk 16470	MR	MR	R	R	MS	MS	R	R	-	-	-	-	-	MR	MR	S	R	MR	MR	MS	R	R	R	R	R	-	-	-	-	Y	R	
3	CoP 16439	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	R	R	R	R	MR	MR	MS	R	R	R	R	R	-	-	-	-	Y	MS	
4	CoSe 16452	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	MR	MR	R	R	MR	MR	R	R	R	R	R	R	-	-	-	-	-	-	-



Sl. No	Genotypes	Red rot												Smut		Wilt		YLD		
		Motipur				Seorahi				Pusa				Buralikson		Motipur	Seorahi	Pusa	Motipur	Seorahi
		Plug		Nodal		Plug		Nodal		Plug		Nodal								
		CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08	CF07	CF08			
AVT (II-Plant Mid Late)																				
1	CoLk 15468	MR	MR	R	R	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	-
2	CoLk 15469	MR	MR	R	R	-	-	-	-	R	MR	R	R	-	-	-	-	-	-	-
3	CoP 15438	MR	MR	R	R	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	-
4	CoP 15439	MR	MR	R	R	-	-	-	-	MR	MR	R	R	-	-	-	-	-	-	-
5	CoP 15440	MR	MR	R	R	-	-	-	-	MR	MR	R	R	MS	MR	-	-	-	-	-
6	CoSe 15453	MR	MR	R	R	-	-	-	-	-	-	-	-	MR	MR	-	-	-	-	-
7	CoSe 15454	MR	MR	R	R	-	-	-	-	-	-	-	-	-	-	-	W	-	-	-
Checks																				
1	CoJ 64	HS	HS	-	-	-	-	-	-	-	-	-	-	R	-	-	-	-	-	-
2	CoSe 95422	S	S	S	R	HS	S	S	S	S	S	MR	MR	MR	MR	S	-	S	-	-
3	Co 1158	-	-	-	-	-	-	-	-	-	-	-	-	HS	S	-	-	-	-	-
4	CoLk 7701	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	BO 91	-	-	-	-	MR	MR	R	R	MR	MR	R	R	-	-	-	-	R	MR	-
6	CoLk 94184	-	-	-	-	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	-	-
7	CoP 9301	-	-	-	-	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	-	-
8	CoP 06436	-	-	-	-	MS/	MR	R	R	MR	MR	R	R	-	-	-	-	-	-	-
9	CoSe 01421	-	-	-	-	MR	MR	R	R	MR	MR	R	R	-	-	-	-	-	-	MR



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

Sl. No.	Genotypes	Anakapalle				Cuddalore				
		Red rot (CF06)		Smut	Wilt	YLD	Red rot (CF06)		Smut	YLD
		Plug	Nodal				Plug	Nodal		
IVT – Early										
1	CoOr 18346	R	R	MR	R	R	MR	R	MR	R
2	CoV 18356	R	R	MR	R	R	MR	R	MR	R
3	CoV 18357	R	R	MR	R	R	MR	R	MR	R
AVT – Early I Plant										
1	CoA 17321	R	R	MS	MS	R	MR	R	S	R
2	CoA 17323	R	R	HS	MS	R	MR	R	MS	R
3	CoC 17336	R	R	S	MS	MR	MR	R	MS	MR
AVT – Early II Plant										
1	CoA 16321	R	R	MS	S	R	MR	R	MR	MR
2	CoC 16336	MS	R	MR	MS	R	MS	R	MS	MR
3	CoC 16337	MS	R	S	MR	R	MR	R	MS	MR
4	CoV 16356	MR	R	S	S	R	MR	R	MS	R
AVT – Midlate Plant I										
1	CoC 15339	MR	R	HS	MR	R	MR	R	MS	MR
2	CoC 16338	MS	R	HS	MR	R	MS	R	S	MR
3	CoC 16339	MR	R	MR	MS	MR	MR	R	MR	MR
4	CoOr 15346	R	R	MR	MR	R	MR	R	MR	R
5	CoV 16357	R	R	MS	S	R	MR	R	S	MR
Checks										
1	Co 06030	MR	R	MR	R	R	-	-	-	-
2	Co 86249	R	R	MR	R	MR	R	R	HS	S
3	CoA 11321	R	R	MR	S	S	-	-	-	-
4	CoA 92081	R	R	HS	MS	R	-	-	-	-
5	CoC 01061	MR	R	MR	MS	MS	-	-	-	-
6	CoOR 03151	MR	R	S	MR	MR	-	-	-	-
7	CoV 92102	MR	R	MR	S	MR	-	-	-	-
8	Co 419	HS	S	HS	-	-	-	-	-	-
9	Co 997	HS	S	MS	-	-	-	-	-	-
10	Co 6907	S	S	MS	-	-	-	-	-	-
11	Co 7219	S	R	MS	-	-	-	-	-	-
12	Co 7706	S	R	S	-	-	-	-	-	-
13	CoA 89085	MS	R	MS	-	-	-	-	-	-
14	CoC 671	HS	S	MS	-	-	HS	S	HS	HS
15	CoA 14321	-	-	-	S	-	-	-	-	-
16	2012A 246	-	-	-	HS	-	-	-	-	-
17	2012A 249	-	-	-	S	-	-	-	-	-
18	CoV 09356	-	-	-	-	MS	-	-	-	-
19	2001A 63	-	-	-	-	MS	-	-	-	-



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

Sl No.	Genotypes	Red rot												Smut			YLD		
		Coimbatore		Thiruvalla				Navsari				Pune	Coimbatore	Navsari	Coimbatore	Navsari	Thiruvalla		
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal										
IVT Early																			
1	Co 17001	MR	R	R	R	R	R	R	R	R	R	R	R	HS	MS	HS	2.6	-	
2	Co 17002	R	R	MR	R	R	R	MR	R	R	R	R	R	R	R	R	2.3	-	
3	Co 17003	MR	R	MR	R	R	R	R	R	R	R	R	R	MS	MS	MS	2.6	-	
4	Co 17004	MR	R	S	R	MS	R	MR	R	R	R	R	R	R	R	R	3.0	-	
5	Co 17005	R	R	MR	R	MR	R	MR	R	R	R	R	R	R	R	S	0.0	-	
6	Co 17006	R	R	MR	R	MR	R	MR	R	R	R	R	R	HS	S	HS	4.0	-	
7	Co 17008	R	R	-	-	-	-	R	R	R	R	R	R	MS	MS	MS	0.0	-	
8	Co 17010	R	R	MR	R	MR	R	MR	R	R	R	R	R	R	R	S	0.6	-	
9	Co 17012	MR	R	-	-	-	-	MR	R	R	R	R	R	MS	MS	MS	0.0	-	
10	Co 17013	MR	R	MR	R	MR	R	MR	R	R	R	R	R	MR	MR	MS	4.3	-	
11	Co 17014	MR	R	MR	R	MR	R	MR	R	R	R	R	R	S	S	HS	0.0	-	
12	CoN 17071	HS	S	S	S	S	S	MS	R	R	R	R	R	R	R	R	3.0	-	
13	CoN 17072	MS	R	MS	R	MS	R	MR	R	R	R	R	R	R	R	R	0.0	-	
14	CoT 17366	MR	R	-	R	MR	R	MR	R	R	R	R	R	HS	MR	R	3.0	-	
15	CoVc 17061	R	R	R	R	R	R	MS	R	R	R	R	R	MS	MS	MS	0.0	-	
16	CoVSI 17021	HS	S	-	S	S	S	HS	R	R	R	R	R	MS	MR	MS	0.0	-	
17	MS 17081	MR	R	MR	R	MR	R	MS	R	R	R	R	R	R	R	R	3.0	-	
18	MS 17082	MS	R	-	-	-	-	HS	S	S	R	R	R	R	R	R	1.0	-	
AVT (1 plant)																			
1	Co 11015	MS	R	MS	R	MS	R	MS	R	R	R	R	R	S	MR	R	2.0	R	
2	Co 14005	MR	R	MS	R	MR	R	MR	R	R	R	R	R	HS	MS	R	0.0	MS	
3	Co 15005	R	R	MR	R	MR	R	MR	R	R	R	R	R	HS	MS	R	2.0	R	
4	Co 15006	MS	R	MR	R	MR	R	MS	R	R	R	R	R	MR	R	R	4.6	S	
5	Co 15007	MS	R	MR	R	MR	R	MS	R	R	R	R	R	S	S	S	0.0	MS	
6	Co 15009	R	R	MR	R	MS	R	MS	R	R	R	R	R	R	R	R	0.0	R	



Sl No.	Genotypes	Red rot												Smut			YLD			
		Coimbatore		Thiruvalla				Navsari				Coimbatore			Navsari			Thiruvalla		
		Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Plug	Nodal	Coimbatore	Navsari	Pune	Coimbatore	Navsari	Thiruvalla	
7	Co 15010	MS	R	MS	R	MS	R	MS	R	MS	R	MS	R	MS	MR	MS	2.6	MR	R	
8	Co 15017	MS	R	MR	R	MR	R	MR	R	MR	R	MR	R	MR	MR	R	0.5	R	R	
9	Co 15021	MR	R	MR	R	MR	R	MR	R	MR	R	MR	R	MR	HS	MS	0.0	MS	R	
10	CoN 15071	HS	S	S	R	S	R	MR	R	MR	R	MR	R	MR	HS	MS	1.6	R	R	
11	CoSnk 15102	MS	R	S	R	S	R	HS	R	S	R	HS	R	MR	S	MS	0.0	MS	R	
12	PI15131	MR	R	MS	R	MS	R	S	R	HS	R	S	HS	MR	MR	R	1.0	S	R	
AVT (II plant)																				
1	Co 14002	-	-	MR	R	MS	R	MS	R	MS	R	MS	R	MR	-	-	R	R	R	
2	Co 14004	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	S	-	R	MR	R	
3	Co 14012	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	HS	-	R	R	R	
4	Co 14016	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	HS	-	R	MR	R	
5	Co 14027	-	-	MS	R	MS	R	MS	R	MS	R	MS	R	MS	HS	-	R	HS	R	
6	Co 14030	-	-	MS	R	MR	R	MR	R	MR	R	MR	R	MR	MR	-	R	MS	R	
7	Co 14032	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	R	-	R	MS	R	
8	CoN 14073	-	-	MS	R	MS	R	MR	R	MR	R	MR	R	MR	R	-	R	R	R	
9	CoSnk 14102	-	-	MS	R	MS	R	MR	R	MR	R	MR	R	MR	MS	-	R	MS	R	
10	CoSnk 14103	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	MS	-	R	MS	R	
11	CoT 14367	-	-	MR	R	MR	R	MS	R	S	R	MR	R	MR	R	-	R	R	R	
12	CoTI 14111	-	-	R	R	R	R	MR	R	MR	R	MR	R	MR	MS	-	R	MS	R	
13	CoVc 14062	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	MR	-	R	S	R	
14	MS 14081	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	MR	-	R	MR	R	
15	MS 14082	-	-	MR	R	MR	R	R	R	MR	R	MR	R	MR	MR	-	R	R	R	
Checks																				
1	Co 86032	-	-	MS	R	MS	R	S	R	S	R	R	R	MR	MR	MS	3.0	S	-	
2	Co 09004	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	MS	R	1.3	-	-	
3	CoC 671	HS	S	S	S	HS	S	HS	S	HS	S	S	S	MR	MR	S	2.0	R	-	
4	CoSnk 05103	-	-	MR	R	MR	R	MR	R	MR	R	MR	R	MR	MR	-	-	MR	-	
5	Co 85004	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-	-	
6	Co 86002	-	-	-	-	-	-	-	-	-	-	-	-	-	HS	-	-	-	-	
7	Co 97009	-	-	-	-	-	-	-	-	-	-	-	-	HS	HS	-	-	MS	-	
8	Co 96007	-	-	-	-	-	-	-	-	-	-	-	-	HS	HS	-	-	-	-	
9	CoM 0265	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	MS	-	



SI No.	Genotypes	Red rot												Smut			YLD		
		Coimbatore				Thiruvalla				Navsari									
		Plug		Nodal		Plug		Nodal		Plug		Nodal		Coimbatore	Navsari	Pune			
		CF06	CF06	CF06	CF12	CF06	CF12	CF06	CF12	CF06	CF12	CF06	CF12						
10	Co 94012	HS	-	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11	Co 740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12	Co 7219	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	



Summary

- In Plant Pathology discipline under AICRP on Sugarcane, eight trials were conducted to sixteen AICRP(S) centers in different sugarcane producing zones of the country during 2020-2021.
- In identification of pathotypes in red rot pathogen program, isolated isolates of red rot pathogen were evaluated and validated with existing red rot pathotypes. Based on virulence pattern of new red rot pathotype, the new virulent pathotype caused severe red rot epidemics has been designated as CF13 and will be used for red rot screening in North West and North Central zones, respectively in place of CF09 and CF07.
- In evaluation of zonal varieties for Red rot, Smut, Wilt, YLD, Rust and Pokkahboeng program, the participating centres identified good number of R/MR entries against these diseases across the country.
- In survey of sugarcane diseases naturally occurring in the area on important varieties program, Under North West Zone, severe red rot was noticed in Co 0238 (70-100%) in few locations of Uttar Pradesh state. In Peninsular zone, up to 11% smut was reported in Co 86002, CoSi 95071 and Co 97009. The brown rust was severe in Western and Central Maharashtra in varieties like CoM 0265 and Co 86032. There were severe outbreaks of PB in different varieties like CoM 0265 and Co 86032. There were severe outbreaks of PB in different varieties along with top borer and mealy bug infestation in the spindle which was found to aggravate the disease severity.
- In assessment of elite and ISH genotypes for resistance to red rot program, good number of elite clones against red rot resistance identified in different sugarcane producing zones in the country.
- In screening, epidemiology and management of pokkahboeng in sugarcane program, nine centres participated in screening of entries for PB resistance and identified good number of R/MR genotypes. The PB management experiment results showed that sett treatment with carbendazim + foliar spray with carbendazim @ 0.1% at 15 days interval was found effective for better germination and PB management.
- In management of yellow leaf disease through meristem culture program, the participating centers reported that tissue culture raised seedlings are free from YLD disease and also gives better plant growth and vigour and higher yield.
- In efficient delivery of fungicides and other agro inputs to manage major fungal diseases in sugarcane program, the participating centres reported that for the sett treatment with fungicides as well as bio-control agents like *Paenibacillus alvei* and *Trichoderma harzianum*, the STD can be easily used in protecting the setts from soil borne inoculum and improving plant survival.

ENTOMOLOGY

Sugarcane crop cultivation has been challenged by a large number of insect pests causing an average yield loss of 20-30 percent. About two dozen insect pests cause severe damage to the crop and thereby invite attention of the researchers for their management. Owing to various ill effects of chemical pesticides, due emphasis is desired on managing the menace of insect pests through non-chemical methods. In varietal development programme, screening of different genotypes of sugarcane against insect pests for their tolerance/ resistance in different zones of India under AICRP (Sugarcane) is one of the strongest tools to manage these pests without reliance on pesticides. Major research focus is inclined towards non-pesticide tools including utilization of bio-agents and IPM. Survey and monitoring of insect pests and their bio-agents are the major thrust area under AICRP (S) for better understanding on changing insect pest and bioagent population dynamics and subsequent formulation of management strategies at national level. During the year 2020-2021, following programmes were assigned at different centres in Entomology discipline.

E.4.1: Evaluation of zonal varieties/genotypes for their

reaction against major insect-pests

- E. 28: Survey and surveillance of sugarcane insect-pests
- E. 30: Monitoring of insect-pests and bio-agents in sugarcane agro-ecosystem
- E.34: Standardization of simple and cost-effective techniques for mass multiplication of sugarcane bio-agents
- E. 40: Integrated approach to manage white grubs in sugarcane
- E. 41: Assessment of yield losses caused by borer pests of sugarcane under changing climate scenario

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

Data on percent natural incidence of different insect pests was recorded on different varieties/ genotypes. In few cases, data on percent intensity and infestation index, number of insects/ leaf, number of insects/ sq cm of leaf etc. is calculated and grading is done accordingly. Details of grading for major insect pests is mentioned in table 4.1.

Fig 4.1 Grading of insect pest reaction against sugarcane varieties/ genotypes

Sl. No.	Pest	Grades		
		Less Susceptible (LS)	Moderately Susceptible (MS)	Highly Susceptible (HS)
1.	Early shoot borer (% incidence)	Below 15.0	15.1-30.0	Above 30.0
2.	Root borer (% incidence)	Below 15.0	15.1-30.0	Above 30.0
3.	Stalk borer (Infestation index)	Below 2.0	2.1-5.0	Above 5.0
4.	Internode borer (% incidence)	Below 20.0	20.1-40.0	Above 40.0
5.	Top borer (% incidence)	Below 10.0	10.1-20.0	Above 20.0
6.	Termite (% incidence)	Below 10.0	10.1-35.0	Above 35.0
7.	Pyrilla (Nymph+Adult / leaf)	Below 5.0	5.1-20.0	Above 20.0
8.	Mealy bug (% incidence)	Below 5.0	5.1-30.0	Above 30.0
9.	Scale insect (% incidence)	Below 10.0	10.1-35.0	Above 35.0
10.	White fly (Nymph + Puparia / sq. inch)	Below 2.0	2.1-5.0	Above 5.0
11.	Sugarcane Woolly Aphid (% leaf area covered by aphid colony)	Below 25.0	25.1-50.0	Above 50.0



North West Zone

AVT (EARLY) I PLANT

Karnal

Five genotypes viz., Co 15025, Co 16029, CoLk 16201, CoLk 16202, CoPb 16181 along with one standard (check) Co 0238 were evaluated against major insect pests of the area. All the genotypes were less susceptible (LS) against early shoot borer (ESB), top borer and stalk borer except two genotypes CoLk 16201 and CoPb 16181, which were moderately susceptible (MS) to Stalk borer. All the genotypes were MS against root borer. (Table 4.2).

Lucknow

Altogether nine sugarcane genotypes viz; CoLk 14201, Co 15025, Co 16029, CoLk 16201, CoLk 16202, CoPb 16181 including three standards viz; CoJ 64, Co 0238, Co 05009 were evaluated against major insect pests. All the genotypes were MS against top borer except CoJ 64 and Co 0238, which were highly susceptible (HS). All the genotypes were HS against stalk borer except CoLk 14201, which was MS. It is noteworthy that all the genotypes were less susceptible against root borer. Out of 9 genotypes, 4 each were LS and MS and only one genotype (Co 16029) was HS against internode borer. All the genotypes were LS against pink borer except Co 15025, which was MS. Genotypes CoLk 16202, CoPb 16181 and CoJ 64 were LS against termites and rest other genotypes were MS (Table 4.2).

Shahjahanpur

Altogether nine sugarcane genotypes viz; CoLk 14201, Co 15025, Co 16029, CoLk 16201, CoLk 16202, CoPb 16181 including three standards viz; CoJ 64, Co 0238, Co 05009 were evaluated against major insect pests. All the genotypes showed LS reaction to ESB, stalk borer and top borer except CoPb 16181 and Co 05009, which were MS to top borer. (Table 4.2).

AVT (EARLY) II PLANT

Karnal

Seven genotypes viz., Co 15023, Co 15024, Co 15027, CoLk 15201, CoLk 15205, CoPb 15212 and one standard check Co 0238 were evaluated against major insect pests. All the genotypes were LS against ESB, top borer and stalk borer except CoLk 15201, which was MS to stalk borer. Against root borer, CoLk 15201, CoLk 15205, CoPb 15212 were LS and rest other genotypes were MS (Table 4.3).

Lucknow

Altogether seven genotypes viz; Co 15027, CoLk 15201, CoLk 15205, CoPb 15212 including three standards viz; CoJ 64, Co 0238, Co 05009 were evaluated against major insect pests. All the genotypes were MS against top borer except CoJ 64 and Co 0238, which were HS. All the genotypes were HS against stalk borer. All the genotypes were MS against internode borer except CoLk 15205, CoPb 15212 and CoJ 64, which were LS. It is noteworthy that all the genotypes were LS against root borer except Co 15027, which was MS. All the genotypes were LS against pink

borer. Only one genotype CoJ 64 was LS against termites and rest other genotypes were MS (Table 4.3).

Shahjahanpur

Altogether nine genotypes viz; Co 15023, Co 15024, Co 15027, CoLk 15201, CoLk 15205, CoPb 15212 including three standards viz; CoJ 64, Co 0238, Co 05009 were evaluated against major insect pests. All the genotypes along with standards showed LS reaction to ESB and stalk borer. All the genotypes showed LS reaction against top borer except Co 15023, CoLk 15205 and Co 0238, which were MS. (Table 4.3).

AVT (MIDLATE) I PLANT

Karnal

Five genotypes viz., Co 16030, CoLk 16203, CoLk 16204, CoS 16232, CoS 16233 along with standard check Co 05011 were evaluated against major insect pests. All the genotypes evaluated were LS against ESB, top borer and stalk borer except one genotype, CoS 16232 which was MS against stalk borer. Against root borer, all the genotypes were MS except one genotype, CoLk 16203 which was LS. (Table 4.4).

Lucknow

Altogether 8 genotypes viz; Co 16030, CoLk 16203, CoLk 16204, CoS 16232, CoS 16233 including standard checks CoS 767, CoPant 97222 and Co 05011 were evaluated against major insect pests. All the genotypes were HS against stalk borer and all the genotypes showed MS reaction against top borer except one genotype, Co 16030, which was HS. All the genotypes were LS against root borer, pink borer and internode borer except two genotypes, CoLk 16203, CoLk 16204, which were MS against internode borer. All the genotypes showed MS reaction against termites except CoLk 16204 and CoS 767 showed LS reaction. (Table 4.4)

Shahjahanpur

Altogether 8 genotypes viz; Co 16030, CoLk 16203, CoLk 16204, CoS 16232, CoS 16233 including standard checks CoS 767, CoPant 97222 and Co 05011 were evaluated against major insect pests. All the genotypes showed LS reaction against ESB, stalk borer and top borer. (Table 4.4).

AVT (MIDLATE) II PLANT

Karnal

Altogether eight genotypes viz. Co 15026, CoLk 15206, CoLk 15207, CoLk 15209, CoPb 15213, CoS 15232, CoS 15233 and standard check Co 05011 were evaluated against major insect pests. All the genotypes evaluated were LS against ESB, top borer and stalk borer except 2 genotypes, CoLk 15209 and Co 05011 which were MS against stalk borer. Against root borer, all the genotypes were LS except three genotypes, CoLk 15206, CoS 15233 and Co 05011, which showed MS reaction (Table 4.5).

Lucknow

Altogether nine genotypes viz. CoLk 15206, CoLk 15207, CoLk 15209, CoPb 15213, CoS 15232, CoS 15233 including standard checks CoS 767, CoPant 97222 and Co

05011 were evaluated against major insect pests. All the genotypes showed HS reaction against stalk borer, MS reaction against top borer and LS reaction against internode borer, root borer and pink borer. Against termites, CoLk 15206, CoLk 15207, CoLk 15209 and CoS 767, showed LS reaction and rest other genotypes showed MS reaction (Table 4.5).

Shahjahanpur

In mid-late maturing group, 10 sugarcane genotypes viz; Co 15026, CoLk 15206, CoLk 15207, CoLk 15209, CoPb 15213, CoS 15232, CoS 15233 including standard checks CoS 767, CoPant 97222 and Co 05011 were evaluated against major insect pests. All the genotypes showed LS reaction against ESB and stalk borer except one genotype CoS 15232, which showed MS reaction against stalk borer. Three genotypes viz., CoLk 15206, CoS 15232 and Co 05011 were LS against top borer and rest other genotypes showed MS reaction (Table 4.5).

AVT (EARLY) RATOON

Karnal

Seven genotypes viz., Co 15023, Co 15024, Co 15027, CoLk 15201, CoLk 15205, CoPb 15212 and one standard check Co 0238 were evaluated against major insect pests. All the genotypes showed LS reaction against ESB, stalk borer, top borer and black bug and all the genotypes showed MS reaction against root borer (Table 4.6).

Lucknow

Altogether six genotypes viz; CoLk 15201, CoLk 15205, CoPb 15212 including three standards viz; CoJ 64, Co 0238, Co 05009 were screened against major insect pests. All the genotypes were MS against top borer except CoPb 15212, which was LS. All the genotypes were HS against stalk borer except Co 0238, which showed MS reaction. It is noteworthy that all the genotypes showed LS reaction against black bug and internode borer (Table 4.6).

Shahjahanpur

Altogether nine genotypes viz., Co 15023, Co 15024, Co

15027, CoLk 15201, CoLk 15205, CoPb 15212 including three standards viz; CoJ 64, Co 0238, Co 05009 were screened against major insect pests. All the genotypes showed LS reaction against ESB, stalk borer and top borer except one genotype, Co 05009, which showed MS reaction against top borer (Table 4.6).

AVT (MIDLATE) RATOON

Karnal

Altogether eight genotypes viz. Co 15026, CoLk 15206, CoLk 15207, CoLk 15209, CoPb 15213, CoS 15232, CoS 15233 and standard check Co 05011 were evaluated against major insect pests. All the genotypes showed LS reaction against ESB, stalk borer, top borer and black bug. Against root borer, all the genotypes were MS except two genotypes, CoS 15232 and CoS 15233, which showed HS reaction (Table 4.7).

Lucknow

Altogether nine genotypes viz. CoLk 15206, CoLk 15207, CoLk 15209, CoPb 15213, CoS 15232, CoS 15233 including standard checks CoS 767, CoPant 97222 and Co 05011 were evaluated against major insect pests. All the genotypes showed HS reaction against stalk borer. Against top borer only two genotypes, CoLk 15206 and CoS 15232 showed LS reaction and rest other were MS (5 nos.) and HS ((2 nos.)). All the genotypes showed LS reaction against root borer and internode borer except two genotypes, CoPb 15213 and CoS 15233, which showed MS reaction against internode borer (Table 4.7).

Shahjahanpur

In mid-late maturing group (ratoon), 10 sugarcane genotypes viz; Co 15026, CoLk 15206, CoLk 15207, CoLk 15209, CoPb 15213, CoS 15232, CoS 15233 including standard checks CoS 767, CoPant 97222 and Co 05011 were evaluated against major insect pests. All the genotypes showed LS reaction against ESB and stalk borer. All the genotypes showed LS reaction except Co 15026, CoS 767 and CoPant 97222 showed MS reaction and CoPb 15213 showed HS reaction against top borer (Table 4.7).



Table 4.2. AVT (Early) I Plant (NW Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Stalk Borer		Top Borer		Internode Borer		Root Borer		Pink Borer		Termite	
		Karnal	Shahjahanpur	Karnal	Lucknow	Shahjahanpur	Karnal	Lucknow*	Shahjahanpur	Lucknow	Karnal	Lucknow	Karnal	Lucknow	Karnal
1.	CoLk 14201	-	LS	-	MS	LS	LS	MS	LS	-	LS	LS	LS	MS	MS
2.	Co 15025	LS	LS	LS	HS	LS	LS	MS	LS	MS	LS	LS	MS	MS	MS
3.	Co 16029	LS	LS	LS	HS	LS	LS	MS	HS	MS	LS	LS	LS	MS	MS
4.	CoLk 16201	LS	LS	MS	HS	LS	LS	MS	MS	MS	LS	LS	LS	MS	MS
5.	CoLk 16202	LS	LS	LS	HS	LS	LS	MS	LS	MS	MS	LS	LS	LS	LS
6.	CoPb 16181	LS	LS	MS	HS	LS	LS	MS	MS	MS	LS	LS	LS	LS	LS
7.	CoJ 64	-	LS	-	HS	LS	LS	HS	LS	HS	LS	LS	LS	LS	LS
8.	Co 0238	LS	LS	LS	HS	LS	LS	HS	MS	MS	MS	LS	LS	MS	MS
9.	Co 05009	-	LS	-	HS	LS	LS	MS	MS	-	MS	LS	LS	MS	MS

*Highest grade is taken out of 3rd and 4th brood.

Table 4.3. AVT (Early) II Plant (NW Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Stalk Borer		Top Borer		Internode Borer		Root Borer		Pink Borer		Termite	
		Karnal	Shahjahanpur	Karnal	Lucknow	Shahjahanpur	Karnal	Lucknow*	Shahjahanpur	Lucknow	Karnal	Lucknow	Karnal	Lucknow	Karnal
1.	Co 15023	LS	LS	LS	-	LS	LS	-	MS	MS	-	MS	-	-	-
2.	Co 15024	LS	LS	LS	-	LS	LS	-	LS	MS	-	MS	-	-	-
3.	Co 15027	LS	LS	LS	HS	LS	LS	MS	LS	MS	MS	MS	LS	MS	MS
4.	CoLk 15201	LS	LS	MS	HS	LS	LS	MS	LS	MS	LS	LS	LS	MS	MS
5.	CoLk 15205	LS	LS	LS	HS	LS	LS	MS	MS	LS	LS	LS	LS	MS	MS
6.	CoPb 15212	LS	LS	LS	HS	LS	LS	MS	LS	MS	LS	LS	LS	MS	MS
7.	CoJ 64	-	LS	-	HS	LS	LS	HS	LS	HS	-	LS	LS	LS	LS
8.	Co 0238	LS	LS	LS	HS	LS	LS	HS	MS	MS	MS	MS	LS	MS	MS
9.	Co 05009	-	LS	-	HS	LS	LS	MS	LS	MS	-	MS	LS	MS	MS

*Highest grade is taken out of 3rd and 4th brood.



Table 4.4. AVT (Midlate) I Plant (NW Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Stalk Borer		Top Borer		Internode Borer		Root Borer		Pink Borer		Termite	
		Karnal	Shahjahanpur	Karnal	Shahjahanpur	Shahjahanpur	Karnal	Shahjahanpur	Shahjahanpur	Shahjahanpur	Karnal	Shahjahanpur	Karnal	Shahjahanpur	Karnal
1.	Co 16030	LS	LS	LS	HS	LS	HS	LS	LS	MS	LS	LS	MS	LS	MS
2.	CoLk 16203	LS	LS	LS	HS	LS	HS	MS	MS	LS	LS	LS	MS	LS	MS
3.	CoLk 16204	LS	LS	LS	HS	LS	HS	MS	MS	MS	LS	LS	MS	LS	LS
4.	CoS 16232	LS	LS	MS	HS	LS	HS	MS	MS	LS	LS	LS	MS	LS	MS
5.	CoS 16233	LS	LS	LS	HS	LS	HS	MS	MS	LS	LS	LS	MS	LS	MS
6.	CoS 767	-	LS	-	HS	LS	HS	MS	MS	LS	LS	-	LS	LS	LS
7.	CoPant 97222	-	LS	-	HS	LS	HS	MS	MS	LS	LS	-	LS	LS	MS
8.	Co 05011	LS	LS	LS	HS	LS	HS	MS	MS	LS	LS	MS	LS	LS	MS

*Highest grade is taken out of 3rd and 4th brood.

Table 4.5. AVT (Midlate) II Plant (NW Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Stalk Borer		Top Borer		Internode Borer		Root Borer		Pink Borer		Termite	
		Karnal	Shahjahanpur	Karnal	Shahjahanpur	Shahjahanpur	Karnal	Shahjahanpur	Shahjahanpur	Shahjahanpur	Karnal	Shahjahanpur	Karnal	Shahjahanpur	Karnal
1.	Co 15026	LS	LS	LS	-	LS	-	MS	-	LS	-	-	-	-	-
2.	CoLk 15206	LS	LS	LS	HS	LS	MS	LS	LS	MS	LS	LS	MS	LS	LS
3.	CoLk 15207	LS	LS	LS	HS	LS	MS	MS	LS	LS	LS	LS	MS	LS	LS
4.	CoLk 15209	LS	LS	MS	HS	LS	MS	MS	LS	LS	LS	LS	MS	LS	LS
5.	CoPb 15213	LS	LS	LS	HS	LS	MS	MS	LS	LS	LS	LS	MS	LS	MS
6.	CoS 15232	LS	LS	LS	HS	MS	MS	MS	LS	LS	LS	LS	MS	LS	MS
7.	CoS 15233	LS	LS	LS	HS	LS	MS	MS	LS	MS	LS	LS	MS	LS	MS
8.	CoS 767	-	LS	-	HS	LS	MS	MS	LS	-	LS	LS	-	LS	LS
9.	CoPant 97222	-	LS	-	HS	LS	MS	MS	LS	-	LS	LS	-	LS	MS
10.	Co 05011	LS	LS	MS	HS	LS	MS	MS	LS	MS	LS	LS	MS	LS	MS

*Highest grade is taken out of 3rd and 4th brood.



Table 4.6. AVT (Early) Ratoon (NW Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Stalk Borer		Top Borer		Root Borer		Black bug		Internode Borer	
		Karnal	Shahjahanpur	Karnal	Lucknow	Shahjahanpur	Karnal	Lucknow	Karnal	Lucknow	Karnal	Lucknow	Karnal
1.	Co 15023	LS	LS	LS	-	LS	-	LS	MS	-	LS	-	-
2.	Co 15024	LS	LS	LS	-	LS	-	LS	MS	-	LS	-	-
3.	Co 15027	LS	LS	LS	-	LS	-	LS	MS	-	LS	-	-
4.	CoLk 15201	LS	LS	LS	HS	LS	MS	LS	MS	LS	LS	LS	LS
5.	CoLk 15205	LS	LS	LS	HS	LS	MS	LS	MS	LS	LS	LS	LS
6.	CoPb 15212	LS	LS	LS	HS	LS	LS	LS	MS	LS	LS	LS	LS
7.	CoJ 64	-	LS	-	HS	-	MS	LS	-	LS	-	LS	LS
8.	Co 0238	LS	LS	LS	MS	LS	MS	LS	MS	LS	LS	LS	LS
9.	Co 05009	-	LS	-	HS	-	MS	MS	-	LS	-	LS	LS

Table 4.7. AVT (Midlate) Ratoon (NW Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Stalk Borer		Top Borer		Root Borer		Black bug		Internode Borer	
		Karnal	Shahjahanpur	Karnal	Lucknow	Shahjahanpur	Karnal	Lucknow	Karnal	Lucknow	Karnal	Lucknow	Karnal
1.	Co 15026	LS	LS	LS	-	LS	-	MS	MS	-	LS	-	-
2.	CoLk 15206	LS	LS	LS	HS	LS	LS	LS	MS	LS	LS	LS	LS
3.	CoLk 15207	LS	LS	LS	HS	LS	MS	LS	MS	LS	LS	LS	LS
4.	CoLk 15209	LS	LS	LS	HS	LS	MS	LS	MS	LS	LS	LS	LS
5.	CoPb 15213	LS	LS	LS	HS	LS	HS	HS	MS	LS	LS	MS	MS
6.	CoS 15232	LS	LS	LS	HS	LS	LS	LS	HS	LS	LS	LS	LS
7.	CoS 15233	LS	LS	LS	HS	LS	HS	LS	HS	LS	LS	MS	MS
8.	CoS 767	-	LS	-	HS	LS	MS	MS	-	LS	-	LS	LS
9.	CoPant 97222	-	LS	-	HS	LS	MS	MS	-	LS	-	LS	LS
10.	Co 05011	LS	LS	LS	HS	LS	MS	MS	MS	LS	LS	LS	LS



Peninsular Zone

IVT

Mandya

Twenty one genotypes with their zonal checks (Co 86032, CoC 671 and Co 09004) were screened for their reaction against major sugarcane pests. All the genotypes showed LS reaction against ESB, top borer and internode borer except three genotypes viz., Co 17013, Co 17014, CoVC 1706, which showed MS reaction against internode borer (Table 4.8).

Padegaon

Twenty one genotypes with their zonal checks (Co 86032, CoC 671 and Co 09004) were screened for their reaction against major sugarcane pests. All the genotypes showed LS reaction against ESB, top borer and scale insects. Against internode borer, only two genotypes Co 17003 and CoT 17366 showed LS reaction and rest other genotypes were either MS (14 nos.) or HS (5 nos.). All the genotypes were HS against mealy bug except one genotype, MS 17082, which showed MS reaction (Table 4.8).

AVT-I PLANT

Coimbatore

Altogether 14 genotypes were screened against ESB and internode borer. Only two genotypes, viz., Co 14005 and Co 15017 showed LS reaction against ESB and rest other genotypes showed either MS reaction (6 nos.) or HS reaction (6 nos.). Against internode borer, only one genotype Co 15009, showed LS reaction and rest other genotypes either MS (12 nos.) or HS (1 no.) reactions (Table 4.9).

Mandya

Altogether 15 genotypes with their Zonal checks (Co 86032, CoC 671 and Co 09004) were screened for their reaction against major sugarcane insect pests. All the genotypes showed LS reaction against ESB, internode borer and top borer. (Table 4.9).

Padegaon

Fifteen genotypes were screened against ESB, internode borer, top borer, mealy bug and scale insect. On the basis of cumulative per cent incidence, all the entries were found LS to ESB and top borer. Only one genotype, CoSNK 15102 showed LS reaction against internode borer and rest other genotypes showed either MS (6 nos.) or HS (8 nos.) reaction. Against scale insect only one genotype, Co 09004 showed HS reaction and rest others were either MS (4 nos.) or LS (10 nos.). It is noteworthy that all the genotypes showed HS reaction against mealy bug (Table 4.9).

Pune

Altogether 15 genotypes with their Zonal checks (Co 86032, CoC 671 and Co 09004) were screened for their reaction against major insect pests. All the genotypes showed LS reaction against ESB and internode borer. Against mealy bug, all the genotypes showed LS reaction except three genotypes, Co 1500, Co 15021 and CoN 15071, which showed MS reaction (Table 4.9).

Tharsa

Altogether 13 genotypes with their Zonal checks (Co 86032 and CoC 671) were screened for their reaction against major insect pests. All the genotypes showed LS reaction against ESB and Pyrilla except Co 15009 and Co 15017, which showed MS reaction against ESB. Only one genotype, Co 15009, showed LS reaction against scale insect and rest other genotypes showed MS reaction (Table 4.9).

AVT-II PLANT

Coimbatore

Eighteen genotypes including three check varieties (Co 86032, CoC 671 and CoSnk 05103) were screened against major insect pests. Only 4 genotypes (Co 14027, MS 14081, MS 14082 and CoSnk 05103) showed LS reaction against ESB and rest other genotypes were either MS (12 nos.) or HS (2 nos.). Against internode borer, all the genotypes showed MS reaction except three genotypes, Co 14032, Co 86032 and CoSnk 05103, which showed HS reaction (Table 4.10).

Mandya

In this experiment 18 genotypes including their zonal checks (Co 86032, CoC 671 and CoSnk 05103) were screened for their reaction against major sugarcane pests. All the genotypes showed LS reaction against ESB, internode borer and top borer (Table 4.10).

Padegaon

Eighteen genotypes with their zonal checks (Co 86032, CoC 671 and CoSnk 05103) were screened for their reaction against major sugarcane pests. All the entries showed LS reaction against ESB and top borer and HS reaction against mealy bug. Against internode borer, 11 entries showed MS and 7 entries showed HS reactions and none of the entries showed LS reaction. All the entries showed LS reaction against scale insect except Co 14032 and MS 14082, which showed MS reaction (Table 4.10).

Pune

Altogether eighteen genotypes including three check varieties (Co 86032, CoC 671 and CoSnk 05103) were screened against major insect pests. All the genotypes showed LS reaction against ESB, internode borer and mealy bug except two genotypes, Co 14030 and CoSnk 14102, which showed MS reaction against mealy bug. (Table 4.10).

AVT-RATOON

Coimbatore

Eighteen entries were screened against internode borer. All the entries showed HS reaction against internode borer except two entries, CoN 14073 and CoSnk 05103, which showed MS reaction. (Table 4.11).

Padegaon

Altogether eighteen entries including three check varieties (Co 86032, CoC 671 and CoSnk 05103) were screened against major insect pests. All the entries showed LS reaction against ESB and top borer. Against internode



borer, 5 entries showed HS reaction, 13 entries showed MS reaction and none of the entry showed LS reaction. All the entries showed HS reaction against mealy bug and scale insect except MS 14081, which showed MS reaction against scale insect. (Table 4.11).

Pune

Eighteen genotypes including three check varieties (Co

86032, CoC 671 and CoSnk 05103) were screened against major insect pests. All the genotypes showed LS reaction against ESB, internode borer. Against mealy bug, 11 genotypes showed LS reaction and 7 genotypes showed MS reaction. None of the genotype showed HS reaction against mealy bug (Table 4.11).

Table 4.8. IVT (Peninsular Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Internode Borer		Top Borer		Mealy bug	Scale Insect
		Mandya	Padegaon	Mandya	Padegaon	Mandya	Padegaon	Padegaon	Padegaon
1.	Co 17001	LS	LS	LS	MS	LS	LS	HS	LS
2.	Co 17002	LS	LS	LS	HS	LS	LS	HS	LS
3.	Co 17003	LS	LS	LS	LS	LS	LS	HS	LS
4.	Co 17004	LS	LS	LS	MS	LS	LS	HS	LS
5.	Co 17005	LS	LS	LS	MS	LS	LS	HS	LS
6.	Co 17006	LS	LS	LS	MS	LS	LS	HS	LS
7.	Co 17008	LS	LS	LS	HS	LS	LS	HS	LS
8.	Co 17010	LS	LS	LS	MS	LS	LS	HS	LS
9.	Co 17012	LS	LS	LS	MS	LS	LS	HS	LS
10.	Co 17013	LS	LS	MS	MS	LS	LS	HS	LS
11.	Co 17014	LS	LS	MS	HS	LS	LS	HS	LS
12.	CoVC 17061	LS	LS	MS	MS	LS	LS	HS	LS
13.	CoN 17071	LS	LS	LS	MS	LS	LS	HS	LS
14.	CoN 17072	LS	LS	LS	MS	LS	LS	HS	LS
15.	MS 17081	LS	LS	LS	MS	LS	LS	HS	LS
16.	MS 17082	LS	LS	LS	MS	LS	LS	MS	LS
17.	CoVSI 17121	LS	LS	LS	HS	LS	LS	HS	LS
18.	CoT 17366	LS	LS	LS	LS	LS	LS	HS	LS
19.	Co 86032 (S)	LS	LS	LS	MS	LS	LS	HS	LS
20.	CoC 671 (S)	LS	LS	LS	HS	LS	LS	HS	LS
21.	Co 09004 (S)	LS	LS	LS	MS	LS	LS	HS	LS



Table 4.9. AVT - I Plant (Peninsular Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer			Internode Borer			Top Borer		Mealy bug		Scale Insect		Pyrilla	
		Coim-batore	Mandya	Pade-gaon	Coim-batore	Mandya	Pade-gaon	Mandya	Pade-gaon	Pade-gaon	Pune	Pade-gaon	Tharsa	Pade-gaon	Tharsa
1.	Co 11015	MS	LS	LS	MS	LS	MS	LS	LS	HS	LS	LS	-	-	-
2.	Co 14005	LS	LS	LS	MS	LS	MS	LS	LS	HS	LS	LS	LS	LS	LS
3.	Co 15005	MS	LS	LS	MS	LS	HS	LS	LS	HS	LS	LS	LS	LS	LS
4.	Co 15006	-	LS	LS	-	LS	HS	LS	LS	HS	LS	LS	LS	LS	LS
5.	Co 15007	HS	LS	LS	MS	LS	HS	LS	LS	HS	MS	MS	LS	LS	LS
6.	Co 15009	HS	LS	LS	LS	LS	HS	LS	LS	HS	LS	LS	MS	MS	LS
7.	Co 15010	HS	LS	LS	MS	LS	MS	LS	LS	HS	LS	MS	LS	LS	LS
8.	Co 15017	LS	LS	LS	MS	LS	MS	LS	LS	HS	LS	MS	LS	LS	LS
9.	Co 15021	HS	LS	LS	MS	LS	HS	LS	LS	HS	MS	LS	LS	LS	LS
10.	CoSnk 15102	HS	LS	LS	MS	LS	LS	LS	LS	HS	LS	MS	LS	LS	LS
11.	CoN 15071	HS	LS	LS	MS	LS	HS	LS	LS	HS	MS	LS	LS	LS	LS
12.	PI 15131	MS	LS	LS	MS	LS	MS	LS	LS	HS	LS	LS	LS	LS	LS
13.	Co 86032 (S)	MS	LS	LS	MS	LS	HS	LS	LS	HS	LS	LS	LS	LS	LS
14.	CoC 671 (S)	MS	LS	LS	HS	LS	MS	LS	LS	HS	LS	LS	LS	LS	LS
15.	Co 09004 (S)	MS	LS	LS	MS	LS	HS	LS	LS	HS	LS	HS	HS	-	-



Table 4.10. AVT - II Plant (Peninsular Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer			Internode Borer			Top Borer		Mealy bug		Scale Insect
		Coim - batore	Mandya	Pade - gaon	Pune	Coim - batore	Mandya	Pade - gaon	Pune	Pade - gaon	Pune	
1.	Co 14002	MS	LS	LS	LS	MS	LS	HS	LS	HS	LS	LS
2.	Co14004	MS	LS	LS	LS	MS	LS	HS	LS	HS	LS	LS
3.	Co14012	MS	LS	LS	LS	MS	LS	HS	LS	HS	LS	LS
4.	Co14016	MS	LS	LS	LS	MS	LS	MS	LS	HS	LS	LS
5.	Co 14027	LS	LS	LS	LS	MS	LS	HS	LS	HS	LS	LS
6.	Co 14030	MS	LS	LS	LS	MS	LS	MS	LS	HS	MS	LS
7.	Co 14032	MS	LS	LS	LS	HS	LS	MS	LS	HS	LS	MS
8.	CoN 14073	MS	LS	LS	LS	MS	LS	MS	LS	HS	LS	LS
9.	CoSnk 14102	MS	LS	LS	LS	MS	LS	MS	LS	HS	MS	LS
10.	CoSnk 14103	HS	LS	LS	LS	MS	LS	HS	LS	HS	LS	LS
11.	CoT 14367	HS	LS	LS	LS	MS	LS	MS	LS	HS	LS	LS
12.	CoTI 14111	MS	LS	LS	LS	MS	LS	MS	LS	HS	LS	LS
13.	CoVC 14062	MS	LS	LS	LS	MS	LS	HS	LS	HS	LS	LS
14.	MS 14081	LS	LS	LS	LS	MS	LS	MS	LS	HS	LS	LS
15.	MS 14082	LS	LS	LS	LS	MS	LS	MS	LS	HS	LS	MS
16.	Co 86032(S)	MS	LS	LS	LS	HS	LS	MS	LS	HS	LS	LS
17.	CoC 671(S)	MS	LS	LS	LS	MS	LS	MS	LS	HS	LS	LS
18.	CoSnk 05103 (S)	LS	LS	LS	LS	HS	LS	HS	LS	HS	LS	LS



Table 4.11. AVT - Ratoon (Peninsular Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Internode Borer			Top Borer		Mealy bug		Scale Insect
		Padegaon	Pune	Coim-batore	Padegaon	Pune	Padegaon	Pune	Padegaon	Pune	
1.	Co 14002	LS	LS	HS	HS	LS	LS	HS	LS	HS	
2.	Co 14004	LS	LS	HS	HS	LS	LS	HS	MS	HS	
3.	Co 14012	LS	LS	HS	HS	LS	LS	HS	LS	HS	
4.	Co 14016	LS	LS	HS	MS	LS	LS	HS	MS	HS	
5.	Co 14027	LS	LS	HS	HS	LS	LS	HS	MS	HS	
6.	Co 14030	LS	LS	HS	MS	LS	LS	HS	MS	HS	
7.	CoM 14032	LS	LS	HS	MS	LS	LS	HS	LS	HS	
8.	CoN 14073	LS	LS	MS	MS	LS	LS	HS	LS	HS	
9.	Co Snk 14102	LS	LS	HS	MS	LS	LS	HS	MS	HS	
10.	CoSnk 14103	LS	LS	HS	MS	LS	LS	HS	LS	HS	
11.	CoT 14367	LS	LS	HS	HS	LS	LS	HS	LS	HS	
12.	CoTL 14111	LS	LS	HS	MS	LS	LS	HS	LS	HS	
13.	CoVc 14062	LS	LS	HS	MS	LS	LS	HS	MS	HS	
14.	MS14081	LS	LS	HS	MS	LS	LS	HS	LS	MS	
15.	MS 14082	LS	LS	HS	MS	LS	LS	HS	LS	HS	
16.	Co 86032 (S)	LS	LS	HS	MS	LS	LS	HS	LS	HS	
17.	CoC 671(S)	LS	LS	HS	MS	LS	LS	HS	MS	HS	
18.	Cosnk 05103 (S)	LS	LS	MS	MS	LS	LS	HS	LS	HS	



North Central & North East Zone

IVT (EARLY)

Pusa

In IVT (Early) altogether 11 entries including 3 standards were evaluated for their reaction against major insect pests, viz., ESB, top borer, stalk borer and root borer. All the entries were LS against ESB, stalk borer and root borer. Against top borer, 6 entries showed LS and 5 entries showed MS reactions (Table 4.12).

AVT (EARLY) I PLANT

Pusa

In AVT (Early)-Ist Plant, 8 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries were LS against ESB, stalk borer and root borer. Against top borer, three entries, CoP 16437, CoLk 16468 and CoSe 95422 were LS and rest other entries showed MS reaction (Table 4.13).

Seorahi

In AVT (Early)-Ist Plant, 8 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries showed LS reaction against ESB, top borer, stalk borer and root borer (Table 4.13).

AVT (EARLY) II PLANT

Pusa

In AVT (Early)-2nd Plant, 8 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries were LS against ESB, stalk borer and root borer except CoSe 95422, which showed MS reaction against ESB. Against top borer, three entries, CoLk 15467, CoSe 15452 and CoSe 01421 were LS and rest other entries showed MS reaction (Table 4.14).

Seorahi

In AVT (Early)-2nd Plant, 8 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries showed LS reaction against ESB, top borer, stalk borer and root borer (Table 4.14).

IVT (MIDLATE)

Pusa

In IVT (Mid late) altogether 9 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries were LS against ESB, stalk borer and root borer. Against top borer, 6 entries showed LS and 3 entries showed MS reactions (Table 4.15).

AVT (MIDLATE) I PLANT

Pusa

In AVT (Midlate)-Ist Plant, 7 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries were LS against ESB, stalk borer and root borer except CoBln 16502 and BO 91, which showed MS reaction against ESB. Against top borer, three entries, CoP 16439, CoBln 16502 and CoP06436 were LS and rest other entries showed MS reaction (Table 4.16).

Seorahi

In AVT (Midlate)-Ist Plant, 7 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries showed LS reaction against ESB, top borer, stalk borer and root borer (Table 4.16).

AVT (MIDLATE) II PLANT

Pusa

In AVT (Midlate)-2nd Plant, 10 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries were LS against ESB and root borer. Against top borer, 4 entries, CoP 15438, CoSe 15453, CoP 0643 and CoP 9301 were LS and rest other entries showed MS reaction. All entries showed LS reaction against stalk borer except CoP 15440, BO 91 and CoP 06436, which showed MS reaction. (Table 4.17).

Seorahi

In AVT (Midlate)-2nd Plant, 10 entries including 3 standards were evaluated for their reaction against major insect pests viz., ESB, top borer, stalk borer and root borer. All the entries showed LS reaction against ESB, top borer, stalk borer and root borer (Table 4.17).

Table 4.12. IVT-(Early) (NC & NE Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Top Borer		Stalk Borer		Root Borer	
		Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi
1.	CoSe 16454	LS	LS	LS	LS	LS	LS	LS	LS
2.	CoP 17436	LS	LS	MS	LS	LS	LS	LS	LS
3.	CoP 17437	LS	LS	LS	LS	LS	LS	LS	LS
4.	CoP 17438	LS	LS	MS	LS	LS	LS	LS	LS
5.	CoP 17440	LS	LS	LS	LS	LS	LS	LS	LS
6.	CoP 17441	LS	LS	LS	LS	LS	LS	LS	LS
7.	CoSe 17451	LS	LS	MS	LS	LS	LS	LS	LS
8.	CoBlN 17501	LS	LS	MS	LS	LS	LS	LS	LS
9.	CoLk 94184(Std.)	LS	LS	LS	LS	LS	LS	LS	LS
10.	CoSe 95422 (Std.)	LS	LS	MS	LS	LS	LS	LS	LS
11.	CoSe 01421 (Std.)	LS	LS	LS	LS	LS	LS	LS	LS

Table 4.13. AVT-I Plant (Early) (NC & NE Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Top Borer		Stalk Borer		Root Borer	
		Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi
1.	CoP 16437	LS	LS	LS	LS	LS	LS	LS	LS
2.	CoP 16438	LS	LS	MS	LS	LS	LS	LS	LS
3.	CoLk 16466	LS	LS	MS	LS	LS	LS	LS	LS
4.	CoLk 16468	LS	LS	LS	LS	LS	LS	LS	LS
5.	CoSe 16451	LS	LS	MS	LS	LS	LS	LS	LS
6.	CoLk 94184(Std.)	LS	LS	MS	LS	LS	LS	LS	LS
7.	CoSe 95422 (Std.)	LS	LS	LS	LS	LS	LS	LS	LS
8.	CoSe 01421 (Std.)	LS	LS	MS	LS	LS	LS	LS	LS

Table 4.14. AVT-II Plant (Early) (NC & NE Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Top Borer		Stalk Borer		Root Borer	
		Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi
1.	CoLk 15466	LS	LS	MS	LS	LS	LS	LS	LS
2.	CoLk 15467	LS	LS	LS	LS	LS	LS	LS	LS
3.	CoP 15436	LS	LS	MS	LS	LS	LS	LS	LS
4.	CoSe 15452	LS	LS	LS	LS	LS	LS	LS	LS
5.	CoSe 15455	LS	LS	MS	LS	LS	LS	LS	LS
6.	CoLk 94184(Std.)	LS	LS	MS	LS	LS	LS	LS	LS
7.	CoSe 95422 (Std.)	MS	LS	MS	LS	LS	LS	LS	LS
8.	CoSe 01421 (Std.)	LS	LS	LS	LS	LS	LS	LS	LS



Table 4.15. IVT-(Mid late) (NC & NE Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Top Borer		Stalk Borer		Root Borer	
		Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi
1.	CoSe 16455	LS	LS	LS	LS	LS	LS	LS	LS
2.	CoSe 16456	LS	LS	MS	LS	LS	LS	LS	LS
3.	CoP 17444	LS	LS	LS	LS	LS	LS	LS	LS
4.	CoP 17446	LS	LS	LS	LS	LS	LS	LS	LS
5.	CoSe 17452	LS	LS	LS	LS	LS	LS	LS	LS
6.	CoBln 17502	LS	LS	MS	LS	LS	LS	LS	LS
7.	BO 91(Std.)	LS	LS	MS	LS	LS	LS	LS	LS
8.	CoP 9301 (Std.)	LS	LS	LS	LS	LS	LS	LS	LS
9.	CoP 06436 (Std.)	LS	LS	LS	LS	LS	LS	LS	LS

Table 4.16. AVT-I Plant (Mid late) (NC & NE Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Top Borer		Stalk Borer		Root Borer	
		Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi
1.	CoP 16439	LS	LS	LS	LS	LS	LS	LS	LS
2.	CoLk 16470	LS	LS	MS	LS	LS	LS	LS	LS
3.	CoSe 16452	LS	LS	MS	LS	LS	LS	LS	LS
4.	CoBln 16502	MS	LS	LS	LS	LS	LS	LS	LS
5.	BO 91(Std.)	MS	LS	MS	LS	LS	LS	LS	LS
6.	CoP 06436(Std.)	LS	LS	LS	LS	LS	LS	LS	LS
7.	CoP 9301(Std.)	LS	LS	MS	LS	LS	LS	LS	LS

Table 4.17. AVT-II Plant (Mid late) (NC & NE Zone)

Sl. No.	Variety/ Genotypes	Early Shoot Borer		Top Borer		Stalk Borer		Root Borer	
		Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi	Pusa	Seorahi
1.	CoLk 15468	LS	LS	MS	LS	LS	LS	LS	LS
2.	CoLk 15469	LS	LS	MS	LS	LS	LS	LS	LS
3.	CoP 15438	LS	LS	LS	LS	LS	LS	LS	LS
4.	CoP 15439	LS	LS	MS	LS	LS	LS	LS	LS
5.	CoP 15440	LS	LS	MS	LS	MS	LS	LS	LS
6.	CoSe15453	LS	LS	LS	LS	LS	LS	LS	LS
7.	CoSe15454	LS	LS	MS	LS	LS	LS	LS	LS
8.	BO 91(Std.)	LS	LS	MS	LS	MS	LS	LS	LS
9.	CoP 06436(Std.)	LS	LS	LS	LS	MS	LS	LS	LS
10.	CoP 9301(Std.)	LS	LS	LS	LS	LS	LS	LS	LS



East Coast Zone

Anakapalle

In AVT (early)-I Plant, 6 entries were evaluated including 3 zonal checks against major insect pests of the area. All entries were MS against ESB and HS against internode borer. All entries showed HS reaction against scale insect except CoC 01061, which showed LS reaction (Table 4.18).

In AVT (early)-II Plant, 6 genotypes including 3 zonal checks were screened against major insect pests. All entries were MS against ESB. Against internode borer, only one entry, CoC 16336 was MS and rest all

entries were HS. Overall 2 entries showed LS reaction against scale insect and rest others showed MS (1 no.) and HS (3 nos.) reactions (Table 4.18).

In AVT (mid-late)-I Plant, 9 genotypes including 4 zonal checks were screened against ESB, internode borer and scale insect. All genotypes showed MS reaction against ESB except CoOr 15346 and CoA 99082, which have HS reaction. Against internode borer, only CoC 16338 showed LS reaction and rest all entries have MS (1 no.) and HS (7 nos.) reactions. Only one entry, CoOr 15346 has LS reaction against scale insect and rest other entries have MS (6 nos.) and HS (2 nos.) (Table 4.19).

Table 4.18. AVT (Early)-I Plant & II Plant (East Coast Zone)- Location: Anakapalle

Sl. No.	Variety/ Genotypes	AVT (Early)- I Plant			AVT (Early)- II Plant			
		ESB	Internode borer	Scale Insect	Variety/ Genotypes	ESB	Internode borer	Scale Insect
1.	CoA17321	MS	HS	HS	CoA 16321	MS	HS	LS
2.	CoA 17323	MS	HS	HS	CoC 16336	MS	MS	MS
3.	CoC 17 336	MS	HS	HS	CoC 16337	MS	HS	HS
4.	CoA 92081 (S)	MS	HS	HS	CoA 92081 (S)	MS	HS	HS
5.	CoC01061 (S)	MS	HS	LS	CoC01061 (S)	MS	HS	LS
6.	Co 3151 (S)	MS	HS	HS	Co 3151 (S)	MS	HS	HS

Table 4.19. AVT (Midlate)-I Plant (East Coast Zone)- Location: Anakapalle

Sl. No.	Variety/ Genotypes	AVT (Midlate)- I Plant		
		ESB	Internode borer	Scale Insect
1.	CoC 15339	MS	HS	MS
2.	CoOr 15346	HS	HS	LS
3.	CoC16338	MS	LS	MS
4.	CoC 16339	MS	HS	HS
5.	CoV 16357	MS	HS	MS
6.	CoV 92102 (S)	MS	MS	MS
7.	Co 86249 (S)	MS	HS	HS
8.	Co 6030 (S)	MS	HS	MS
9.	CoA 99082 (Sc)	HS	HS	MS

Project No. E. 28. Survey and surveillance of sugarcane insect-pests

North West Zone

Karnal

The virtual survey carried out, due to Covid19 pandemic. Top borer and pink borer incidences ranged from traces to 70.0 and traces to 17.5 per cent respectively. Black bug incidence varied from traces to 7.00 and traces to 24.00 black bug/leaf in plant and ratoon crop respectively. Grasshopper and pyrilla incidences were recorded in traces. Blister mite incidence varied from traces to 80.0 per cent in leaf sheaths. The incidence of web mite was in some of the field up to 60.0 per cent. (Table 4.20).

Lucknow

The command areas of DSCL Sugar Mills, Loni, Chilbaria Sugar Mill, Nanpara Sugar Mill, Bahraich and Hata Sugar Mill, Deoria, Hata Sugar Mill, Hata, Bahraich and Hata Sugar Mill, Deoria, four units of DSCL, Group (Rupapur, Haryawan, Loni, Ajbapur), three units of Balrampur Group, Sekseria Sugar Mill, Biswan, Sitapur, Rosa Sugar Works Rosa, K. M. Sugar Mill Masodha, Oudh Sugar Mill, Hargaon, Dalmia Chini Mill, Ramgarh, IPL Chini Mill were surveyed during 2020. In few fields, ESB was recorded to the tune of 5.0-10.0%. Occurrence of top borer, stalk borer, internode borer, pyrilla was in traces. The sporadic incidence of army worm (*Spodoptera* sp.) was observed in Bahraich. In ratoon crop, top borer was the



major problem and affecting 10-15% of the shoot. In Chilbaria Sugar Mill, and Nanpara Sugar Mill area, incidence of black beetle (*Heteronychus* sp.) was also observed that gnawing the basal portion of young shoots and causing dead hearts. Its incidence was of wide spread but restricted to around 5-10%. The incidence of root borer (27.0%), cumulative incidence of top borer (16.67%) was observed. Termite incidence was low.

Incidence of a black Delphacid Plant Hopper, *Eoerysa flavocapitata* again reported from District, Muzaffarnagar of western Uttar Pradesh and UCSR, Shahjahanpur. The general appearance of adults is blackish and of newly emerged nymphs is pale green with red eyes and advanced stage nymphs are smoky. Both stages (adult and nymphs) are remaining concealed in leaf funnel/whorl of sugarcane and suck the plant sap. Some sort of sticky honey dew was observed on under surface of newly opened leaves that invited black sooty mould. Under surface of most of the leaves were covered with black sooty mould. In spite of yield loss to the crop it made the green cane tops unfit for cattle feed. Sporadic incidence of leaf mealy bugs was observed during field visits in the area (Table 4.20).

Shahjahanpur

Survey was conducted during pre-monsoon and post-monsoon in different sugar factory zones of six districts viz; Shahjahanpur, (Rosa, Maqsoodapur, Nigohi, Powayan sugar mill), Pilibhit (Pilibhit, Bisalpur, Barkhera sugar mill area), Hardoi (Loni, Hariyawan, Rupapur sugar mill), Sitapur (Biswan, Hargoan sugar mill area), Lakhimpur Kheri (Ajabapur, Kumbhi, Gola, Palia, Gularia, Aira, Khambharkheda sugar mill area) and Bareilly (Faridpur and Nababganj) to assess the major insect pest of the area. During summer weather the incidence of ESB ranged from 0.35% (Ajabapur, Kumbhi, Gola, Palia, Gularia, Aira, Khambharkheda sugar mill area) to 1.25% (Rosa, Maksudapur, Powayan Nigohi sugar mill) on varieties Co 0238. The incidence of top borer was recorded ranged from 0.21% (Ajabapur, Kumbhi, Gola, Palia, Gularia, Aira, Khambharkheda sugar mill area) to 0.75% (Rosa, Maqsoodapur, Nigohi, Powayan, Biswan, Hargoan, Faridpur and Nababganj sugar mill area) on varieties Co 0238, CoS 08272, Co 0118. The incidence of root borer was recorded ranged from 0.5% (Loni, Hariyawan, Rupapur sugar mill area) to 0.75% (Rosa, Maksudapur, Nigohi, Powayan sugar mill area) on Co 0238. The incidence of Termite was recorded ranged from 0.5% (Loni, Hariyawan, Rupapur sugar mill area) to 1.5% (Faridpur and Nababganj sugar mill area) on varieties Co 0238 and Co 0118. The incidence of Thrips was recorded ranged from 0.83% (Pilibhit, Bisalpur, Barkhera sugar mill area) to 3.5% (Rosa, Maksudapur, Nigohi, Powayan sugar mill area) on Co 0238. The defoliator, grass hopper were recorded in stray in all factory zones while army worm was found in stray in almost all factory zones. Sucking pest mealy bug was recorded in stray in all sugar zones except Loni, Hariyawan, Rupapur, Biswan, Hargoan, Faridpur and Nababganj sugar mill area. Gurdaspur borer was recorded in stray in Loni, Hariyawan, Rupapur, Ajabapur, Kumbhi, Gola, Palia,

Gularia sugar mill area. White grub incidence was found in stray at Ajabapur, Kumbhi, Gola, Faridpur and Nababganj sugar mill area (Table 4.20).

North Central Zone

Pusa

Survey was conducted for the insect pests of sugarcane at Pusa Farm during cropping season of 2020-21. Among borers pest, incidence of ESB (4.3 to 12.9%), root borer (3.7 to 9.6%), top borer (2.5 to 16.7%), stalk borer below (3.4 to 8.3%) and Plassey borer (5.6 to 17.2%) were recorded during reported period. While in case of sucking pests, the incidence of black bug (2.6 to 6.8%), pyrilla (5.4 to 13.9%), scale insect (1.6 to 7.4%), mealy bug (2.4 to 8.6%), white fly (5.3 to 18.9%) and derbid plant hopper (4.1 to 10.5%) were observed as the key pests. The incidence of other pests like grasshopper (6.8 to 11.5%), mites 7.8 to 22.6%) and termite (5 to 12%) were also recorded (Table 4.20).

Seorahi

Survey was conducted in Twenty one different sugar factory zones viz., Seorahi, Ramkola, Dhadha, Pratappur, Khadda, Siswabajar, Sathiyav, Goshi, Captangaj, Pipraech, Munderwa, Babhanan, Manakapur, Balrampur, Tulshipur, Utrola, Rudhawali, Kunuderghi, Akberpur, Mausudha and Rauzagaw for key insect-pests of sugarcane. During hot weather, the incidence of top borer 2nd brood was low and ranged from 2.00% in Munderwa factory zone to 4.00% in Ghosi factory zone. Regarding the sucking pest i.e. thrips population / leaf was low. It was ranged from 4.50% (in Pipraich factory zones) to 9.50% (in Pratappur factory zone). Low incidence of mealy bug was observed with a range of 3.00% (in Ramkola, Sathiyav, Munderwa and Siswabajar factory zone) to 5.55% in Seorahi Factory Zone. The incidence of top borer at harvest was recorded low in all surveyed factory zones. The minimum (2.50%) incidence of top borer was recorded around Ramkola factory zone while maximum (8.00%) around Sathiyav factory zone. The infestation of Stalk borer on cane basis was observed low in all surveyed factory zone. It ranged from 4.00% (around Ramkola) to 10.50% (around Pratappur and Pipraech factory zone). The incidence of White fly (Nymph & puperia) 2.5 sq. cm was observed low and ranged from 3.00% (in Mankapur factory zone) to 5.00% (in Masaudha factory zone) (Table 4.20).

Peninsular Zone

Coimbatore

Overall incidence of borer pests, viz. shoot borer (SB) and internode borer (INB) and the subterranean white grub in Tamil Nadu indicated medium incidence of SB (2.3 - 32.2%) and INB (4.5 - 20.1%); white grub incidence in endemic areas varied from 8 to 11 grubs/m². Whitefly incidence was 24-104/leaf in Mundyampakkam area alone. Other pests like mealybug and white woolly aphid were low in individual farmers' fields which were kept under check by periodical detashing and natural enemies respectively (Table 4.20).

Mandya

During 2020-21 survey was conducted at monthly interval in three sugar factory areas of Mandya district. During the survey seven pests and per cent of incidence was recorded viz., early shoot borer, top shoot borer, inter node borer, root grub, woolly aphids, mealy bugs and termites. The natural enemies of woolly aphids *Encarsia flavoscutellum* and *Diphaaphidivora* kept the pest under check. Termite appeared in few places but did not cause economic loss to the crop (Table 4.20).

Padegaon

Survey of sugarcane was carried out in the sugarcane fields of areas of Pune, Satara, and Ahmednagar districts. In most of the fields, CoM 0265 and Co 86032 varieties were planted. The new varieties viz., MS 10001 was also planted in few fields. In Pune district, survey was undertaken in villages viz., Nira, Gulanche, Nimbut. Someshwar, Wanewadi. During the period of survey per cent incidence of ESB, TB and IB ranged from 5.10 to 22.50, 0.00 to 1.80 and 12.60 to 25.00, respectively. Whereas, sucking pests viz., pyrilla, woolly aphids, scale insect, mealy bug and white fly showed their population in the range of 1.50 to 4.50, 5.50 to 32.80, 0.00, 8.00 to 25.30, and 2.55 to 10.56, respectively on above mentioned sugarcane varieties. The infestation of white grub was observed in the range of 1.67 to 3.45 during the crop period. At Pune Dist. borer incidence was found low to moderate level. Sucking pests was found low to moderate level whereas, white grub population was found to be low level. In Satara district, survey was undertaken in villages viz., Balu Patilachi wadi, Pimpare BK, Maryaachi wadi, Padegaon Farm, Taradgaon. During the survey range of per cent incidence of ESB, TB and IB was 3.50 to 15.25, 0.00 and 8.40 to 18.80, respectively. However, sucking pests viz, pyrilla, woolly aphids, scale insect, mealy bug and white fly showed their population in the range of 2.22 to 4.58, 6.25 to 20.50, 0.00, 10.25 to 25.40 and 2.65 to 5.55, respectively on above mentioned sugarcane varieties. The infestation of white grub was observed 1.80 to 2.45% throughout the crop period. In Ahmednagar district, survey was undertaken in villages viz., Loni BK, Gogalgaon, Satral, Kolhar BK, Babhaleshwar, Bagwatipura. During the survey range of per cent incidence of ESB TSB and IB was 10.60 to 40.50, 0.00 and 6.20 to 12.50, respectively. However, sucking pests viz, pyrilla, woolly aphids, scale insect, mealy bug and white fly showed their population in the range of 1.90 to 5.18, 8.00 to 40.00, 6.20 to 20.60 and 8.65 to 40.55, respectively on above mentioned sugarcane varieties. The infestation of white grub was observed in the range of 2.55 to 5.40 throughout the crop period. Overall survey indicated that, borer and sucking pest incidence was low to moderate. White grub was observed low level during middle of June to August 2020 (Table 4.20).

Pune

Survey conducted during 2020-21 revealed that per cent incidence of early shoot borer was in the range of 0.00 to 5.26%, while it was maximum 5.26% in December 2020 ratoon crop of Co 86032. The per cent incidence of

internode borer was in the range 10.00 to 40.00%, while it was maximum 40.00 % in Co 86032 planted in the month on July 2020. The incidence of mealy bug was found maximum 40.00 in CoM 0265 planted in the month of July 2020 (Table 4.20).

Tharsa

Roving survey was conducted in Nagpur, Wardha, Gondia and Bhandara districts during first fortnight of December. Maximum mean incidence (9.13%) of internode borer (*C. sacchariphagus indicus*) was observed on variety Co-9805 at Shivani Bandh village of Sakoli Tahsil in Bhandara district. Maximum mean incidence of pyrilla (*Pyrilla perpusilla*) (4.75 per leaf) was observed on variety MS-10001 at Bhivkhidki of Arjuni Mor Tahsil in Gondia district (Table 4.20).

Thiruvalla

A survey of sugarcane arthropod insect pests was made in cane fields surrounding ARS, Thiruvalla. An abnormal yellowing of cane leaves was observed in all varieties grown in the field resembling potash deficiency. The plant sucking bug, *Phaenacantha bicolor* (Dist.) (Hemiptera: Colobathristidae) was identified as the causal agent of leaf yellow spotting. In order to estimate the degree of infestation, field counts of insects were taken. Four to 20 adults were observed on each plant. A yellow discoloration was observed at the feeding points on the leaves. At high infestation levels, there is an appreciable reduction in photosynthetic activity of leaves, due to the yellowing which could ultimately lead to yield loss. *Phaenacantha bicolor* (Dist.) (Hemiptera: Colobathristidae) is reported from the Indian Subcontinent for the first time. This is the first report of the bug as a pest of sugarcane in India (Table 4.20).

East Coast Zone

Anakapalle

Surveys conducted in Visakhapatnam district revealed incidence of ESB, *C. infuscatellus* (5-40% DH) during February- July months with peak incidence during April month; incidence of fall army worm, *S. frugiperda* (2-5%) during March-May with peak incidence during May month; incidence of sugarcane mite, *O. indicus* (3-15%) during May-June with peak incidence during May month and incidence of termite during March-June with peak incidence during March month during formative stage. Incidence of pink mealybug, *S. sacchari* (10-40%) was observed in June-September with peak incidence during August month and yellow mealybug, *K. sacchari* (20-50%) observed during April-July with peak incidence during July month. Incidence of sugarcane aphid, *M. sacchari* (50-150 aphids/leaf) was noticed during March to January with peak incidence during November month. Incidence of internode borer (10-60%) was noticed during July-October with peak incidence during September month.

A new invasive pest, Rugose Spiralling Whitefly (RSW), *Aleurodicus rugioperculatus* (Hemiptera: Aleyrodidae), which had invaded India in 2016, has been recorded on sugarcane for the first time at RARS, Anakapalle. Its



incidence is recorded to the tune of 5-20% in close proximity to coconut plantation during Oct-Jan with peak incidence during December in Research farm, Anakapalle. Along with RSW, natural enemies viz., lady bird beetles, *Cryptolaemus montrouzieri*, *Chilocorus nigrita*, *Scymnus nubilus* and the parasitoid wasp, *Encarsia guadeloupe* were

recorded in sugarcane ecosystem. The per cent parasitisation of *E. guadeloupe* was high (60-70%) on RSW feeding on sugarcane leaves during January. A sooty mould scavenging beetle, *Leiochrinus nilgiranus* Kaszab (Coleoptera: Tenebrionidae) was also noticed on sugarcane leaves infected with sooty mould. (Table 4.20, Fig 1).



Fig 1: Rugose Spiralling Whitefly infestation on sugarcane & record of its parasitoids & predators

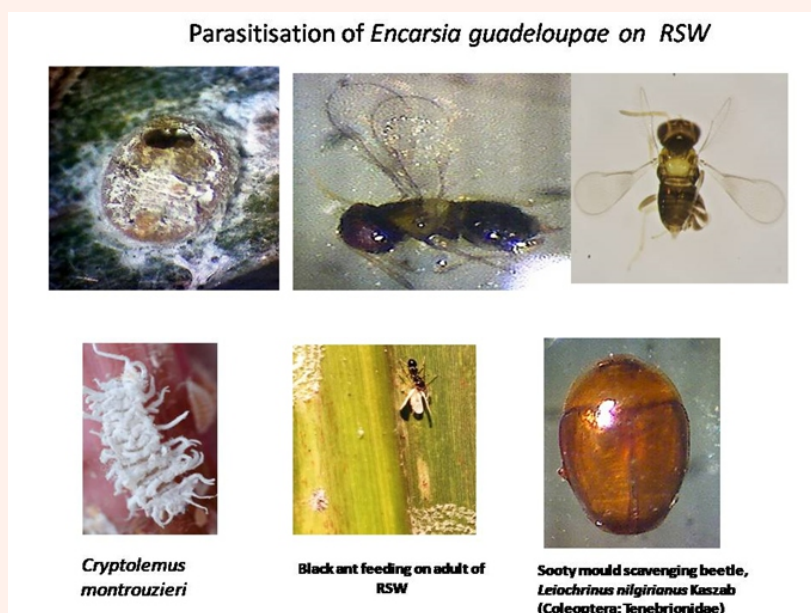


Table 4.20. Status of insect pests of sugarcane in different states of India based on survey and surveillance report.

Location	Insect pest	Incidence (%)	Varieties	Period	Any other information
Andhra Pradesh					
Research farm, RARS, Anakapalle, Ravikamatham mandal Vishakhapatnam District	Early shoot borer	5.0-20.0	87 A 298 (Ratoon), 2009 A 107, 93 A 145	March, 2020	Due to high temperatures low to moderate incidence of early shoot borer was observed on all commercial varieties
	Fall army worm	2.0-3.0			
	Internode borer	3.0-9.0			
	Scale insect	30.0-80.0			
Research farm, RARS, Anakapalle,	Early shoot borer	24.0-40.0	2009 A 107, 87 A 298, 93 A 145	April, 2020	-
	Fall army worm	3.0-5.0			-
Research farm, RARS, Anakapalle,	Early shoot borer	5.0-15.0	93 A 145	May, 2020	-
	Fall army worm	2.0-5.0			-
	Sugarcane mite	5.0-15.0			-



Research farm, RARS, Anakapalle,	Early shoot borer	2.0-8.0	93 A 145	June, 2020	-
	Sugarcane mite	3.0-10.0			-
Lakkavaram(v), Gavaravaram (v), in Chodavaram (M), Boilakinhada (v) in Devarapalli (M) Vishakhapatnam	Early shoot borer	2.0-6.0	2009 A 107 (ratoon) Co 7805 87 A 298 CoA 7706	July, 2020	Along with insect pests, moderate to severe incidence (20 -30%) mosaic, smut (15-20%), YLD (5%) and grassy shoot (5%) were observed on 2099 A 107, 87 A 298 & Co A 7706, CoA 7805 varieties.
	Yellow mealybug	15.0-50.0			
	Internode borer	4.0-20.0			
	Web mite	2.0-5.0			
Lakshmiipuram (V) Gowriapatnam (v) in Chodavaram (M), Vishakhapatnam	Early shoot borer	1.0-5.0	2009A 107, Co 7805, 87A 298, CoA 7706	August, 2020	
	Internode borer	10.0-20.0			
	Web mite	2.0-5.0			
	Sugarcane aphids /leaf	20-45			
	Rusty plum aphids/leaf	5.0-15			
Kotavuratla Vishakhapatnam	Internode borer	5.0-25.0	2009 A 107, 87A 298, Co 7805 and Co7706	September, 2020	
	Sugarcane aphid	30-60			
	Mealybug	5.0-10.0			
	Sugarcane aphids/leaf	25-45			
Chodavaram mandal, Bucchayya peta and Kotvuratla mandalsand RARS, Anakapalle, Visakhapatnam	Internode borer	8.0-10.0	2009 A 107 (ratoon) Co 7805 87 A 298, Co 7805 and Co7706	October, 2020	
	Sugarcane aphid/leaf	30.0-60.0			
	Rugose spiraling white fly	2.0-10.0			
Atchuthapuram, Yellamanchili and Payakarao peta, Kotauratla and Makavara palem mandals and RARS, Anakapalle, Visakhapatnam	Internode borer	4.0-6.0	2009 A 107, 87A 298, Co 62175 and 2003 V 46 COA16321, Co A 16323	November, 2020	-
	Sugarcane aphid /leaf	60.0-150.0			-
	White woolly aphid	5.0-10.0			-
	Rugose spiraling white fly	2.0-13.0			-
Rajam, Garividi mandals in operational area of EID Parrys' India Pvt., Ltd., Sankili in Srikakulam district and RARS, Anakapalle, Visakhapatnam	Early shoot borer	5.0-10.0	2009 A 107, 87A 298, Co86032 and 2003 V 46 Co A 16321, CoA 16323	December, 2020	-
	Internode borer	5.0-10.0			-
	Sugarcane aphid /Leaf	30.0-40.0			-
	Rugose spiralling white fly	2.0-20.0			-
	Web mite	20.0-40.0			-
RARS, Anakapalle, Visakhapatnam	Rugose spiralling white fly (% incidence)	5.0-10.0	Co A 16321, CoA 16323	January, 2021	60-70% parasitization by <i>Encarsia gudeloupa</i>
Bihar					
Pusa Farm	Root borer	3.7-9.6	CoP 2061,	-	-
	Shoot borer	4.3-12.9	CoP 9301,	-	-
	Top borer	2.5-16.7	Rajendra	-	-
	Stalk borer	3.4-8.3	Ganna-1, CoP	-	-
	Plassey borer	5.6-17.2	112, BO	-	-
	Grasshopper	6.8-11.5	154, BO 153	-	-
	Black bug	2.6-6.8		-	-
	Pyrilla	5.4-13.9		-	-
	Scale insect	1.6-7.4		-	-
	Mealy bug	2.4-8.6		-	-
	White fly	5.3-18.9		-	-
	Derbid plant hopper	4.1-10.5		-	-
	Mites	7.8-22.6		-	-
	Termites	5.0-12.0		-	-



Maharashtra					
Pune (Nira, Gulaniche, Nimbut, Someshwar, Waniwadi.)	Early shoot borer	5.1-22.50	Co 86032	-	-
	Top shoot borer	0.0-1.80	CoM 0265	-	-
	Internode borer	12.60-25.00	MS 10001	-	-
	Pyrilla/ leaf	4.50		-	1.0-2.45 nos.of <i>Epiricania melanoleuca</i> /plant
	Woolly aphid	5.50-32.80		-	-
	Mealy bug	8.0-25.30		-	-
	White fly	2.55-10.56		-	-
	White grub	1.67-3.45		-	-
Satara (Balu patilachi wadi, Pimpore BK, Maryaachi wadi, Padegaon Farm, Taradgaon)	Early shoot borer	3.50-15.25	Co 86032	-	-
	Internode borer	8.40-18.80	CoM 0265	-	-
	Pyrilla/ leaf	2.22-4.58	MS 10001	-	0.8-1.8 nos.of <i>E.melanoleuca</i> /plant
	Woolly aphid	6.25-20.50		-	-
	Mealy bug	10.25-25.40		-	-
	White fly	2.65-5.55		-	-
	White grub	1.80-2.45		-	-
Ahmednagar (Loni BK Gogalgaon Satral Kolhar BK Babhaleshwar Bagwatipura)	Early shoot borer	10.60-40.50	Co 86032	-	-
	Internode borer	6.20-12.50	CoM 0265	-	-
	Pyrilla/ leaf	1.90-5.18		-	1.7-2.50 nos.of <i>E.melanoleuca</i> /plant
	Woolly aphid	8.00-40.00		-	-
	Mealy bug	6.20-20.60		-	-
	White fly	8.65-40.55		-	-
	White grub	2.55-5.40		-	-
Pune and nearby areas	Early shoot borer	1.20-5.26	Co 86032		
	Internode borer	10-40	CoM 0265	-	Max. in July planted Co 86032
	Mealy bug	10-40		-	Max. in July planted Co 0265
Nagpur, Wardha, Gondia, Bhandara	Internode borer	1.25-16.70	CoM 0265 Co 8005	1 st fortnight, Dec, 2020	-
	Pyrilla	1.6-6.8	Co 9805 Co 10001 Co 92005		-
Karnataka					
Three sugar mill area of Mandya District	Early shoot borer	7.5-28.0	-	-	-
	Top shoot borer	6.0-18.5	-	-	-
	Internode borer	12.5-29.5	-	-	-
	Mealy bug	12.0	-	-	At maturity
	Woolly aphid	40 – 65	-	-	<i>Encarsia</i> and <i>Dipha</i> found active
	Root grub	3 – 4 grubs / clump	-	-	-
	Termites	-	-	-	Damage in patches
Kerala					
Thiruvalla	<i>Phaenacantha bicolor</i>	4 to 20 adults/plant	-	-	First report from Indian sub-continent
Tamil Nadu					
Coimbatore, Mundyampakkam areas	Shoot borer	2.3-32.2	-	-	-
	Internode borer	4.5-20.1	-	-	-
	White grub	8-11 grubs/m ²	-	-	-
	Whitefly	24-104 nos./leaf	-	-	-



Haryana					
Karnal,	Top borer	0.0 to 70.0	-	-	-
	Pink borer	0.0 to 17.5	-	-	-
	Black bug	0.0 to 07.00 black bug/leaf in plant 0.0 to 24.00 black bug/leaf in ratoon crop	-	-	-
	Grasshopper	Traces	-	-	-
	Pyrilla	Traces	-	-	-
	Blister mite	0.0 to 85.0% in leaf sheaths	-	-	-
	Web mite	60.0%	-	-	-
	Uttar Pradesh				
Rosa, Maksudapur, Powayan, Nigohi sugar mill area (Shahjahanpur district)	ESB	1-5	Co 0238	-	-
	Top borer	0-3		-	-
	Root borer	1-5		-	-
	Army worm	1-3		-	-
	Termite	0-3		-	-
	Thrips	1-2		-	-
	Mealy bug	0-1		-	-
	Grass hopper	0-3		-	-
Pilibhit, Bisalpur and Barkhera sugar mill area (Pilibhit district)	Termite	0-2	Co 0238	-	-
	Root borer	0-2		-	-
	Thrips	0-3		-	-
Loni, Hariyawan, Rupapur Sugar mill area (Hardoi district)	Termite	0-2	Co 0238	-	-
	Top borer	1-3	CoS 08272	-	-
	Thrips	0-8	Co 118	-	-
	Root borer	1-2		-	-
	Gurdaspur Borer	0-2		-	-
	Grass hopper	0-2		-	-
Biswan, Hargaon Sugar mill area (Sitapur district)	Thrips	0-5	Co 0238	-	-
	Top borer	0-2		-	-
Ajbapur, Kumbhi, Gola, Pallia, Gularia, Aira, Khambharkhera sugar mill area (Lakhimpur Kheri)	ESB	0-5	Co 0238	-	-
	Top borer	0-3	Co 0118	-	-
	Root borer	0-2		-	-
	Gurdaspur Borer	0-2		-	-
	Termite	0-5		-	-
	Grass hopper	0-3		-	-
	Thrips	0-7		-	-
	Mealy bug	0-2		-	-
	White grub	0-2		-	-
	Faridpur and Nababganj sugar mill area (Bariely District)	ESB	0-3	Co 0238	-
Top borer		0-3	Co 0118	-	-
Termite		0-5		-	-
Grass hopper		0-3		-	-
White grub		0-1		-	-
Rupapur, Haryawan, Loni, Ajbapur, Hata, Biswan sugar mills area	Early shoot borer	5-10	-	-	-
	Top borer, stalk borer, internode borer, Pyrilla	Traces	-	-	-
Nanpara and Chilberia Sugar Mills area, Bahraich	Black beetle (<i>Heteronychus</i> sp.)	5-10	-	-	-
	Root borer	27.0	-	-	-
	Top borer	16.67	-	-	-



Seorahi, Ramkola, Dhadha, Pratappur, Khadda, Siswabajar, Sathiyav, Goshi, Captangaj, Pipraech, Munderwa, Babhanan, Manakapur, Balrampur, Tulshipur, Utrola, Rudhawali, Kunuderghi, Akberpur, Mausudha and Rauzagaw sugar mills area	Top Borer 2 nd brood	1-6	Co 0238	-	-
	Trips/Leaf	5-13	Co 0118	-	-
	Mealy bugs/plant	1-8	Co 98014	-	-
	Top Borer at harvest	1-12	CoS 08272	-	-
	Stalk Borer at harvest	2-16	CoLk 94184	-	-
			CoP 9301	-	-
			CoS 08279		
	White fly (nymph&pupera) 2.5 sq. cm	2-7			

Project No. E. 30: Monitoring of insect-pests and bio-agents

North West Zone

Karnal

A non-replicated experiment with sugarcane variety, Co 15023 was carried out and monitored the incidence of major insect pests and their bio agents of sugarcane at regular interval. The cumulative incidence of early shoot borer and top borer varied from 2.3 to 4.3 and 5.7 to 7.9 per cent respectively. Pink borer incidence was 7.3 per cent. Incidence of root borer and stalk borer was 28.3 and 24.6 per cent respectively. Termite and pyrilla incidence was in traces. The mean black bug population was 2.0 bug/leaf. Parasitization of top borer larvae by *Isotima javensis* and *Stenobracon deesae* was 3.2 and 2.9 per cent respectively. *Cotesia flavipes*, a larval cum pre pupal parasitoid of stalk borer, was found to parasitize up to 3.1 % stalk borer larvae.

Lucknow

Experiment on monitoring of insect pests of sugarcane was carried out with Co 0238. Planting was done in autumn season of 2019. Recommended agronomic practices were followed to raise a good crop. Average germination was recorded >33.00 percent. Periodic observations on incidence of insect pests and parasitoids of pests were recorded. Incidence of termite in standing crop was 4.55 per cent. Incidence of top borer II, III, IV and V brood was 10.15, 17.88, 26.31 and 16.00 percent, respectively. Incidence of root borer was 13.21 per cent. Incidence of internode borer was 23.68 per cent, while the incidence of stalk borer was 24.81 percent. The incidence of *Pyrilla perpusilla* was in traces and its adult and nymph parasitoid, *Fulgoraesia (Epiricania) melanoleuca* was also noticed in traces. Incidence of mealy bug was 42.46 percent. Black bugs were present in every clump. Parasites like *Telenomus beneficiens* (14.33 to 30.00 % on egg mass basis). Total parasitisation of top borer was 33.33 % due to *Stenobracon* sp. (3.51 to 5.88 %), *Rhaconotus* sp. (7.02 to 11.76%) and *Isotima javensis* (10.53 to 17.65 %) and predatory fauna comprising of Coccinellids, spiders and ants were noticed active in the field at different stages of the crop.

Shahjahanpur

Experiment was conducted with planting of variety UP 05125 in 0.2 ha area at Shahjahanpur (UP) to monitor the key insect pest and their bio-agent. The incidence of early shoot borer was recorded maximum by 3.19%, 2.37% and

2.4% during 24th, 29th and 16th standard meteorological week (SMW), respectively. The incidence of top borer was recorded maximum 4.30% during 35th SMW followed by 2.20%, 1.80% and 1.50% during 31st, 26th and 22nd SMW, respectively. The per cent incidence of stalk borer (on cane basis) was recorded maximum 21.33% during 47th SMW followed by 20.00% during 38th SMW, respectively. The bio-agent viz; *Telenomus beneficiens*, *Isotima javensis*, *Rhaconotus scirpophagae* and *Stenobracon deesae* were recorded as major parasitoids of top borer. *Cotesia flavipes*, a larval parasitoid of stalk borer was also recorded from fields. The peak activity of egg-prasitoid *T. beneficiens* was observed to be 8.00% during 31st SMW and declined up to 1.30% during 35th SMW. A parasitisation of larvae by *I. javensis* was observed from 26th SMW (1.20%) and increase up to 3.30% during 31st SMW thereafter decreases up to 2.10% during 35th SMW. The parasitisation of top borer by *R. scirpophagae* was recorded minimum (1.20%) during 31st SMW which increase up to 2.80% during 35th SMW, thereafter decrease up to 1.40% during 38th SMW. The parasitisation of *S. deesae* ranged from 2.01% during 31st SMW to 2.30% during 38th SMW. The parasitisation of stalk borer larvae by *C. flavipes* was recorded maximum 6.2% during 34th SMW.

North Central Zone

Pusa

Experiment was conducted with planting of sugarcane variety CoP 2061 in 0.2 hectare area at Pusa Farm. The population of root borer, shoot borer, top borer, stalk borer, plassey borer, pyrilla and their natural enemies were recorded at monthly interval during cropping season of 2020-21. The data on monitoring of insect pests and their bio-agents revealed that the mean per cent incidence of root borer, shoot borer, top borer, stalk borer and plassey borer varied from 1.6 to 9.8%, 2.9 to 11.7%, 1.70 to 15.7%, 1.6 to 8.3 % and 3.7 to 16.4%, respectively. Whereas, the incidence of sugarcane Pyrilla was recorded from 1.5 to 12.0 per leaf. The bio-agents of root and early shoot borer were not observed during cropping season of 200-21. While, parasitization of bio-agents such as *Cotesia flavipes*, against top borer, stalk borer and plassey borer were recorded and % parasitization varied from 2.3 to 9.5%, 1.7 to 10.7 and 2.5 to 16.1 respectively. Whereas peak of parasitization was observed in the month of August and stalk/ plassey borer in the month of October. The parasitization by *T. pyrillae* and *E. melanoleuca* were recorded from August to December and July to December,

respectively. Their peaks were noticed in the month of October (11.2 %) and (12.3%), respectively.

Seorahi

The Experiment was conducted in 0.2 ha area with CoS 08272 variety at Seorahi for monitoring the key insect-pests and their natural enemies. The incidence of Shoot borer was recorded maximum (7.89%) during 24th SMW followed by 4.98%, 3.66% and 2.13% during 20th, 16th and 29th SMW respectively. The incidence of top borer was recorded maximum (6.67%) during 35th SMW followed by 4.06%, 3.57%, 2.02% and 1.50% during 31th, 26th, 22nd and 38th SMW, respectively. The percent incidence of stalk borer (on cane basis) was observed to be maximum 10.05% during 43rd SMW followed by 7.20% during 38th SMW, respectively. The bio-agents viz. *Isotima javensis*, *Stenobracon sp.*, *Elasmus zehnteri* and *Rhaconotus scirpophagae* wererecorded as major parasitoids of Top borer and *Cotesia flavipes*, a larval parasitoid of stalk borer was also recorded from the field. Parasitisation of top borer larvae by *Isotima javensis* was recorded minimum 2.00% during 22th SMW and increased up to 20.20% during 35th SMW there after decreased up to 3.63% during 38th SMW. The parasitisation top borer larvae by *Stenobracon sp* was observed with minimum 5.00% during 22nd SMW and increased up to 17.64 % during 35th SMW there after decreased up to 6.25% during 38th SMW. The parasitisation of top borer larvae by *Elasmus zehnteri* was observed with 4.00% during 26th SMW and increases up to 11.42% during 35th SMW there after decreases up to 4.16% during 38th SMW. On top borer larvae, *Rhaconotus scirpophagae* was observed minimum 5.00% during 26th SMW and increased up to 9.37% during 35th SMW there after decreased up to 6.00% during 38th SMW. *Cotesia flavipes* was recorded to parasitize up to 11.11% stalk borer larvae during 43th SMW followed by 9.37% during 38th SMW.

Peninsular Zone

Coimbatore

In monitoring plot, planted in March 2020, pest incidence was assessed at monthly intervals in five random spots. Shoot borer and internode borer were the borer pests but both occurred at low intensity. Shoot borer deadhearts ranged 1.23-6.9% during March-July. Internode borer incidence ranged 0.9-4.9% during September-January, but it was slightly higher (18.8%) at harvest. Whitefly, mealybug and yellow mite were observed at low levels. Parasitoid activity was also observed. Parasitization by *Sturmiopsis inferenson* shoot borer was 12.3 and 10.7% in June and July, respectively.

Mandya

Cumulative incidence of ESB in CoVC 18061 sugarcane variety was 4.25 % in 120 days after planting. Incidence of top borer was 14.25% at 210days after planting. Incidence of internode borer was 26.25%. Aphid, whitefly and pyrilla appeared in very small numbers but failed to establish and spread. Woolly aphid incidence was observed at 150 and 180 days after sowing and it was restricted to few clumps. *Dipha* (2larva/pupa/clump), *Micromus* (2 larva/leaf), kept

the woolly aphid under control.

Padegaon

The data of ESB, Pyrilla, mealy bug, woolly aphid and white flies and their natural enemies was recorded. During the year 2020-21, the incidence of early shoot borer was found in the range of 2.15 to 16.80 per cent. Initial incidence was recorded during 11th SMW week (2.15%). Thereafter the incidence showed increasing trend and recorded peak incidence on 17th SMW with 16.80 per cent. Thereafter, the incidence showed decreasing trend. The parasitism due to *T. chilonis* was observed from 14th SMW to 23rd MW in the range of 0.10 to 3.20 per cent. The infestation of pyrilla was noticed from 32th MW to 41th SMW in the range of 1.00 to 4.20 per leaf. The infestation was very low on sugarcane. However, *E. melanoleuca* was seen during the 34th to 41 SMW with 2.00 to 25.20 per cent parasitism and 1.00 to 2.60 egg mass & cocoon. Mealybug population was noticed from 36th SMW to end of observations i.e. 52nd SMW in the range of 2.00 to 50.00 per 10 plants. Trend of population was found increasing up to end of observations. The predatory coccinellids seen during 40th SMW (0.60) and steadily increased up to 52nd SMW (4.00). The initial population of woolly aphid was observed during 32 SMW (0.50 / 150 leaves). Thereafter population was steadily increased and showed its peak population (30.68 /150 leaves) during 45th SMW. Then after the population showed decreasing trend up to end of the observation (52nd SMW). Predatory *D. aphidivora* observed during 39th SMW with 1.00 larvae. The peak population noticed on 46 SMW (30.00 larvae) then after population showed decreasing up to last observation. Similar trend was also noticed in respect of *Micromus*. The population of *Micromus* observed in the range of 1.00 to 30.00 grubs/150 leaves from 38th SMW to 52nd SMW. The peak population noticed during 47th SMW (30.00 grubs /150 leaves). After that the decreasing trend of population was found. White fly population was noticed from 27th SMW to 42th SMW in the range of 1.56 to 29.66 per leaf. Thereafter population steadily increased and showed its peak population (29.66%) in 34th SMW. Then after population showed in decreasing trend. The population of *Encarsia spp.* was seen in the range of 0.80 to 5.10 per cent parasitism from 28th to 41th SMW.

Pune

The per cent incidence of early shoot borer was maximum 0.64% in 11th SMW (12.03.2020), while plot was free from it in 3rd, 5th and 7th SMW. The per cent incidence of internode borer was maximum 27%, in 31st SMW (30.07.2020), while it was free from it in 19th SMW and 21st SMW. The per cent intensity and infestation index of internode borer was maximum 5.21% and 1.15 respectively in 23rd SMW (10.06.2020).

Tharsa

The insect pests were recorded on sugarcane var. Co-86032 during 2020-21 were early shoot borer, scales and Pyrilla. The seasonal incidence data (Table:1) revealed that infestation of early shoot borer infestation was started in 15th SMW with its initial infestation of 4.25%, reached its peak (10.22 %) in 17th SMW and continued upto 32nd SMW.



It had significant positive correlation with Maximum Temperature, Bright Sunshine, Wind Speed and Evaporation and significant negative correlation with Morning and Evening relative humidity, rainfall and rainy days. However, recorded non-significant correlation with Minimum Temperature.

The incidence of scales insect initiated during 36th SMW (8.00 % incidence and 2.00 % intensity) and it continued. Peak % incidence (36.00 %) and % intensity (10.8 %) was recorded in 41st SMW. It had highly significant positive correlation with wind speed. However, recorded non-significant correlation with other weather parameters.

The incidence of *Pyrilla* was initiated during 12th SMW (0.03 per leaf) and it was continued up to 41st SMW. The peak *Pyrilla* incidence per leaf was recorded in 25th SMW (4.25 per leaf). It had significant positive correlation with Minimum Temperatures, Evening relative humidity, Rainfall and Rainy days. However, recorded non-significant correlation with Maximum Temperatures, Morning relative humidity, bright sunshine, wind speed and evaporation.

Lady bird beetle and spiders were the major generalist predators of the sugarcane insect pests. Their incidence was recorded in 11th and 10th SMW (LBB- 1.1 and Spiders-0.1 per plant), respectively. Lady bird beetle population reached its peak (4.6 per plant) in 19th SMW and spiders (8.2 per plant) in 24th SMW (Table-1.1). Their incidence continued upto 52nd SMW. Incidence of the natural enemies basically correlated with the population of the host insects as they are generalist predator. However, their population recorded non significant correlation with all major weather parameters.

East Coast

Anakapalle

In experiment of monitoring of insect pests in sugarcane ecosystem, peak incidences of early shoot borer (14.0DH%), sugarcane mite (20.0%) and fall army worm (7.0%) were recorded during 2nd FN of May. Peak incidence of internode borer was observed during 1st FN of October (30.0%); sugarcane aphid (110aphids/leaf) during 2nd FN of November; web mite (26.0%) during 1st FN of December and scale insect (20.0%) during 2nd FN of December. The per cent parasitisation of *T.chilonis* (2.60%) is high during 2nd FN of September. The predatory population (*Stethorus punctillum*) of spider mites and the per cent parasitisation of *Aphelinus* sp on sugarcane aphid *M.sacchari* were high during 1st fortnight of December. Association between weather parameters and incidence of major insect pests of sugarcane revealed that incidence of early shoot borer has showed significant positive correlation with maximum ($r= 0.76$) and minimum ($r= 0.72$) temperatures and negative correlation with morning relative humidity ($R= -0.73$). Incidence of internode borer showed significant positive correlation with rainfall ($r=0.50$); incidence of sugarcane mite showed significant positive correlation with maximum & minimum temperatures ($r=0.91, 0.73$) and negative correlation with rainfall ($r= -0.52$), relative humidity ($r= -0.58$) whereas web

mite showed negative correlation with maximum and minimum temperatures ($r= -0.70; -0.74$). Sugarcane aphid showed negative correlation with maximum temperature ($r= -0.35$) and positive correlation with relative humidity ($r=0.39$).

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

North West Zone

Lucknow

Eumicrosoma spp. (Hymenoptera : Scelionidae) is a potential egg parasitoid of black bugs of sugarcane, *Cavelerious sweeti* Myamoto and *Dimorphopterus gibbus* and other chinch bugs of loan grass. *Eumicrosoma* spp. is mass multiplied in the laboratory on laboratory reared eggs of black bugs of sugarcane. Black bugs are mass multiplied on natural host plant in the laboratory. The culture of parasitoid was maintained throughout the year from April, 2020 onwards. *Eumicrosoma* sp. is a black shiny Scelionid wasp. Eggs of black bug *D. gibbus* were used as laboratory host. Fresh eggs (fresh or 24 hour old) are offered to the gravid female in homoeopathic vials for parasitization. Parasitized eggs turn blackish from one end and in few days turned completely black to shiny black just before hatching. No super parasitism was observed. Parasitization ranged from 30.00 to 90.00 percent. Single gravid female could parasitize on an average of 16 eggs with a range of 6-22 eggs. Development period of parasitoid varied from 7-11 days. Parasitization and longevity of adults varied from 79.00 to 92.00 per cent and 1-3 days, respectively.

Peninsular Zone

Coimbatore

For economizing mass production of entomopathogenic fungi (EPF), cotton seed cake was found best for *Metarhizium anisopliae*, sesame seed cake extract for *Beauveria bassiana* and wheat bran and rice bran extracts for *B. brongniartii* based on spore production. Multiplication of the *M. anisopliae* strain (SBIMA-16) was done through liquid fermentation. An improved medium with increased concentrations (10 and 15%; named SBI I & II respectively) of jaggery and amended with supplements was assessed for culturing the EPF and compared with jaggery media without supplements. Efficacy data showed that highest mortality was seen with SBI-I (94.44%) comparable with jaggery 15% and SBI-II (91.67%) but higher than that obtained with YPSS (83.33%). Corresponding colony growth and spore viability of several EPF on solid media revealed superiority of SBI-I medium. In pot culture experiments with various combinations of *B. brongniartii*, *B. bassiana*, *M.anisopliae*, *Heterorhabditis indica*, *Steinernermea glaseri* and six selected insecticides at field recommended dose, EPFs showed high mortality rates of white grub.

Pune

During 2020-21, produced 1787.9 cc *Corcyra* eggs, 1201 *Trichogramma chilonis* cards and 248 *T. pretiosum*

cards. Supplied 914 Tc and 61Tp cards for the control of borers in 65 ha area and 91 cc *Corcyra* eggs were supplied to Govt. Bio-control lab in Maharashtra state as nucleus culture.

East Coast Zone

Anakapalle

Standardization of simple, cost effective techniques for mass multiplication of bioagent (*Cladosporium cladosporioides*), effective against sugarcane woolly aphid, *Ceratovacuna lanigera* was attempted. Crushed grains of sorghum, bajra, maize, rice, ragi and wheat with one per cent yeast extract be assayed for the sustainability for mass production of the fungus, *Cladosporium cladosporioides*. Thirty grams each of these substrates are taken in separate 250 ml conical flasks containing 30 ml of distilled water. After thorough mixing they are plugged with cotton and autoclaved at 15 psi pressure at 121°C for 30 minutes. Circular agar disks of 5 mm diameter are cut from the ten day old fungal culture grown in PDA plates. One disk is transferred to each flask and shaken well to disperse the inoculums. The flasks are incubated in BOD incubator at 25±1 °C. Spores are harvested from eighth day onwards by adding 100 ml of 0.02% Tween-80 in to the flasks followed by filtration through muslin after shaking. Spore concentration in the suspension is estimated microscopically with a Neubauer improved double ruling haemocytometer. Spore counts are taken daily for each substrates from 8th to 10th day after inoculation. Virulence of the pathogen is assayed against white woolly aphid, *Ceratovacuna lanigera*. Among the solid media, par boiled rice produced highest spore count of 16.4 X 10⁵ per 100 gm followed by rice (15.60 X 10⁵) and were found as the suitable medium for mass culturing of *C. cladosporioides* under laboratory conditions. Based on cost incurred for the production of spores, among *in vitro* produced cereal media for the production of spores, parboiled rice (Rs. 0.38), rice (Rs. 0.39) are the best low cost substrates for 1 X 10⁵ spore production compared to other cereal grains.

E. 40: Integrated approach to manage white grubs in sugarcane

Two centres (Padegaon and Pune) in white grub prone area were allotted the trial. The experiment could not be conducted at Padegaon due to Covid-19 pandemic and the trial was vitiated because white grub infestation was very low.

E. 41: Assessment of yield losses caused by borer pests of sugarcane under changing climate scenario

Peninsular Zone

Coimbatore

Yield loss due to internode borer (INB) attack was assessed at harvest in an experimental plot with the popular variety Co 86032. Infested canes were segregated based on the position of INB bore holes in the canes, viz. top, middle, bottom, top-middle, middle-bottom, top-bottom and top-middle-bottom, representing attack in different broods.

Measurements of canegirth, inter node number, cane length and cane weight were taken for sample canes (5-40) in different categories and control. The category 'bottom', though collected, was excluded from analysis since it had only one cane. Data were analysed for variance using the categories as treatments (Table 7). The percent of canes with bore holes in top was the highest (37.4) followed by top-middle (26.2) and top-bottom and middle categories (12.1 each). TMB (6.5) and MB (4.7) had lower percent of canes. Cane girth, internode number and cane length did not differ among the different categories. However, cane weight differed significantly with TMB and TM damage reducing it marginally over control. Overall, the results indicated that repeated attacks of inter node borer in different broods did not result in significant loss in cane yield parameters.

Mandya

The treated plot with recommended chemical insecticide, Chlorantriliprole 0.4 G at 2.25 kg for 0.1 ha. recorded the yield of 94 t/ha whereas the untreated recorded 87 t/ha yield. The yield in untreated plot was comparatively less when compared to treated due to the higher incidence of borers in untreated field.

Padegaon

In protected plot percent incidence of ESB was 0.00, 0.00, 0.11 and 0.08 at 30, 60, 90 and 120 DAP, respectively while it was 0.2, 3.64, 6.17 and 6.09, at 30, 60, 90 and 120 DAP, respectively in unprotected plots. The per cent incidence of internode borer in treated plot and untreated plot showed 1.20 and 4.60, respectively. Top borer was not observed throughout the crop period in both plots. Plot treated with recommended effective chemical insecticide recorded highest germination (56.50 %), No. of millable cane (72.58 thousands ha⁻¹), average cane weight (2.39 kg) and Yield (170.47 t/ha) as against untreated plot. The quality parameters viz., Brix, purity sucrose and CSS% are influenced by plot treated with recommended effective chemical insecticide. The brix(%), purity (%), sucrose (%) and CCS% in treated plots were 20.85, 96.75, 19.09 and 14.25, respectively, while in untreated plots were 19.84, 96.21, 18.91 and 14.10, respectively.

Pune

The cumulative % incidence of early shoot borer was 1.77% in IPM block, while 1.32% in control block. Plant population per ha was numerically high 52857 in IPM Block and it was 50714 in control block. Sugarcane yield per ha was numerically high 104.02 t/ha in IPM block and it was 96.70 in control block.

East Coast Zone

Anakapalle

Cumulative incidence of early shoot borer was 14.42%; 10.96% DH in unprotected plots of 93 A 145 and 87 A 298 varieties respectively, while it was 4.79%; 5.49% DH in protected plots of 93 A 145 and 87 A 298 varieties respectively. Relatively high incidence of internode borer i.e., 60.0%; 62.0% with intensity of 4.48%, 3.80%



respectively, recorded in unprotected plots of 93 A 145 & 87A 298, while it was 48% and 40% with intensity of 2.6% and 1.6% respectively in protected plots of 93 A 145 & 87A 298. The borer attack resulted in 2.77% and 1.72 per cent reduction in cane yields of 93 A 145 (68.57T/ha) & 87A 298

(68.40T/ha) varieties respectively in unprotected plots as against relatively more yields, 70.52T/ha and 69.60T/ha in protected plots. The juice quality (Sucrose%) was also better in protected plots over unprotected plots.

Summary of Entomology

- During the year 2020-21, six projects were conducted in entomology discipline of AICRP (S) at 11 centres (regular and voluntary) under 4 different sugarcane producing zones of India.
- In North West Zone, under project on evaluation of zonal varieties/ genotypes against major insect pests, all the entries were highly susceptible (HS) for one or more than one insect pests except CoLk 14201, Co 15023, Co 15024, Co 15027, Co 15027 in early group and Co 15026 in mid late group which were either less susceptible (LS) or moderately susceptible (MS) against all the major insect pests.
- In North Central Zone, all the genotypes screened were either LS or MS against ESB, top borer, stalk borer and root borer. None of the genotype was HS against any pest.
- In Peninsular Zone, all the entries were HS for one or more than one insect pests except MS 17082 in IVT trial, which was either LS or MS against all the major insect pests at all the centres.
- In East Coast Zone, all the entries were HS for one or more than one insect pests except CoC 16337 in early group and CoC 16338 & CoV 92102 in midlate group which were either LS or MS against all the major insect pests.
- Under project on survey and surveillance of sugarcane insect pests, severe to low incidence of sugarcane insect pests viz., ESB, root borer, internode borer, stalk borer, top borer, plassey borer, fall army worm, white grub, termites, scale insect, white fly, mealy bug, web mite, sugarcane woolly aphid, rusty plum aphid, thrips, black bug were reported from different parts of the country. Some uncommon insect pests viz., plant hopper (*Eoerysa flavocapitata*), blister mite were also reported. Invasive insect pest, Fall army worm (*Spodoptera frugiperda*) was reported this year also on sugarcane from Andhra Pradesh.
- A new invasive pest, Rugose Spiralling Whitefly (RSW), *Aleurodicus rugioperculatus* (Hemiptera: Aleyrodidae), which had invaded India in 2016, has been recorded on sugarcane for the first time at RARS, Anakapalle. Its incidence is recorded to the tune of 5-20 percent. Along with RSW, natural enemies viz., lady bird beetles, *Cryptolaemus montrouzieri*, *Chilocorus nigrita*, *Scymnus nubilus* and the parasitoid wasp, *Encarsia guadelopae* were recorded in sugarcane ecosystem. Besides, a plant sucking bug, *Phaenacantha bicolor* (Dist.) (Hemiptera: Colobathristidae) was recorded as pest of sugarcane at Thiruvalla, Kerala. This is reported from the Indian Subcontinent for the first time.
- The bioagents, viz., *Isotima javensis*, *Cotesia flavipes*, *Rhaconotus scirpophagae*, *Encarsia flavoscutellum*, *E. guadelopae*, *Elasmus zehnteri*, *Sturmiopsis inferens*, *Aphelinus* sp., *Fulgoraesia (Epiricania) melanoleuca*, *Telenomus beneficiens*, *Telenomus* sp., *Stenobracon deesae*, *Stenobracon* sp., *Tetrastichus pyrillae*, *Encarsia flavoscutellum*, *Dipha aphidivora*, *Micromus igorotus*, *Trichogramma chilonis*, *Cryptolaemus montrouzieri*, *Chilocorus nigrita*, *Scymnus nubilus*, *Stethorus punctillum* were found active against different pests in sugarcane.
- Mass multiplication of sugarcane bio-agents using cost effective techniques was done for *Trichogramma chilonis*, *T. pretiosum*, *Eumicrosoma* sp., *Beauveria brongniartii*, *B. bassiana* and *Metarhizium anisopliae* and *Cladosporium cladosporioides* for use against various insect pests.
- Assessment of yield losses caused by borer pests revealed a significant yield loss of cane in unprotected crops over the protected crops. A loss of 50% yield was recorded, on attack of three generations of internode borer on sugarcane.

Execution of AICRP (S) trails at different centers during 2020-21

S. No.	Name of the Centre	Discipline	Trials assigned	Trials conducted	
				YES	NO
PENINSULAR ZONE					
1.	Coimbatore	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Agronomy	AS 72	ALL	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 17E, PP 17F, PP 22, PP 23, PP 33, PP 34	ALL	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 40, E 41	E 4.1, E 28, E 30, E 34, E 41	E 40
2.	Basmath Nagar	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
3.	Belagavi	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	IVT, AVT -I P	AVT-II P, AVT-R
4.	Kolhapur	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	AS 72, AS 74, AS 75	AS 73
5.	Mandya	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 41	E 4.1, E 28, E 30, E 41	E 34
6.	Navsari	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 17E, PP 17F, PP 22, PP 23, PP 33, PP 34	ALL	NIL
7.	Padegaon	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 40, E 41	ALL	NIL
8.	Perumalapalle	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
9.	Powarkheda*	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	AS 72, AS 74, AS 75	AS 73
10.	Pravaranagar	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
11.	Pugalur	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	IVT, AVT -I P, AVT -II P	AVT-R
12.	Raipur (Kawardha)	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	IVT, AVT -I P	AVT-II P, AVT-R
13.	Pune	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	AS 72, AS 74	AS 73, AS 75
		Plant Pathology	PP 17B, PP 17D, PP 17E, PP 17F, PP 22, PP 31, PP 32, PP 33, PP 34	ALL	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 40, E 41	ALL	NIL
14.	Rudrur	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL



15.	Sameerwadi	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
16.	Sankeshwar	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	ALL	NIL
17.	Sirugamani	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	Not reported.	
18.	Thiruvalla	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	ALL	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 17E, PP 22	PP 14, PP 17A, PP 17D, PP 17E, PP 22	PP 14A, PP 17B
		Entomology	E 28	ALL	NIL
19.	Tharsa	Plant Breeding	IVT, AVT -I P, AVT -II P, AVT -R	IVT	AVT -I P, AVT -II P, AVT -R
		Plant Pathology	PP 31	NIL	ALL
		Entomology	E 4.1, E 28, E 30, E 41	E 4.1, E 28, E 30	E 41
East Coast Zone					
1.	Anakapalle	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) -II P, AVT (E) -R, AVT (M) -II P, AVT (M) -R	ALL	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 17E, PP 17F, PP 22, PP 23, PP 31, PP 33, PP 34	ALL	NIL
		Entomology	E 4.1, E 28, E 30, E 34, E 41	ALL	NIL
2.	Cuddalore	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) -II P, AVT (E) -R, AVT (M) -II P, AVT (M) -R	ALL	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 17E, PP 22, PP 23, PP 33, PP 34	ALL	NIL
3.	Nayagarh	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) -II P, AVT (E) -R, AVT (M) -II P, AVT (M) -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	AS 72, AS 74, AS 75	AS 73
4.	Nellikuppam	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) -II P, AVT (E) -R, AVT (M) -II P, AVT (M) -R	ALL	NIL
5.	Vuyyuru	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) -II P, AVT (E) -R, AVT (M) -II P, AVT (M) -R	ALL	NIL
North Central Zone					
1.	Bethuadahari	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) -II P, AVT (E) -R, IVT (M), AVT (M) -I P, AVT (M) -II P, AVT (M) -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	NIL	ALL
2.	Motipur	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) -II P, AVT (E) -R, IVT (M), AVT (M) -I P, AVT (M) -II P, AVT (M) -R	ALL	NIL
		Plant Pathology	PP 17A, PP 17B, PP 17C, PP 17D, PP 17E, PP 22	PP 17A, PP 17B, PP 17C, PP 17D, PP 17E, PP 22	PP 17F



3.	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 72, AS 73, AS 74, AS 75	AS 72, AS 74, AS 75	AS 73
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 17F, PP 22, PP 23, PP 31, PP 34	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 17F, PP 22, PP 23, PP 31,	PP 34
		Entomology	E 4.1, E 28, E 30, E 41	ALL	NIL
4.	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 72, AS 73, AS 74, AS 75	AS 72, AS 75	AS 73, AS 74
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17D, PP 17F, PP 22, PP 23, PP 31, PP 34	ALL	NIL
		Entomology	E 4.1, E 28, E 30, E 41	E 4.1, E 28, E 30	E 41
North Eastern Zone					
1.	Buralikson	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E) - II P, AVT (E) -R, IVT (M), AVT (M)-I P, AVT (M) -II P, AVT (M)-R	AVT (E)-I P, AVT (M) -I P, AVT (M)-II P, AVT (M) -R	IVT (E), AVT (E)-II P, AVT (E) -R, IVT (M),
		Plant Pathology	PP 17A, PP 17D, PP 17F, PP 22	PP 17A, PP 22	PP 17D, PP 17F
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 72, AS 73, AS 74, AS 75	ALL	NIL
2.	Karnal (SBI)	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E) - II P, AVT (E) -R	ALL	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17D, PP 17F, PP 22, PP 23, PP 34	PP 14, PP 14A, PP 17A, PP 17D, PP 22, PP 23	PP 17F, PP 34
		Entomology	E 4.1, E 28, E 30, E 41	E 4.1, E 28, E 30	E 41
3.	Kota	Plant Breeding	IVT (E), AVT (E)-I P, AVT (E) - II P, AVT (E) -R, IVT (M), AVT (M)-I P, AVT (M) -II P, AVT (M)-R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	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 72, AS 73, AS 74, AS 75	ALL	NIL
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 17F, PP 22, PP 23, PP 33, PP 34	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23	PP 17F, PP 33, PP 34
		Entomology	E 4.1, E 28, E 30, E 34, E 41	E 4.1, E 28, E 30, E 34	E 41
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
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 17F, PP 22, PP 23, PP 31, PP 34	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, PP 22, PP 23, PP 31,	PP 17F, PP 34



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	ALL	NIL
		Plant Pathology	PP 17A, PP 17B, PP 17D, PP 17F, PP 22, PP 33	PP 17A, PP 17B, PP 17D, PP 22,	PP 17F, PP 33
8.	Shahjahanpur	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) - II P, AVT (E) -R, IVT (M), AVT (M) -I P, AVT (M) -II P, AVT (M) -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	AS 72, AS 74, AS 75	AS 73
		Plant Pathology	PP 14, PP 14A, PP 17A, PP 17B, PP 17C, PP 17D, P 17F, PP 22, PP 23, PP 31, PP 33, PP 34	ALL	NIL
		Entomology	E 4.1, E 28, E 30, E 41	E 4.1, E 28, E 30	E 41
9.	Sriganga-nagar	Plant Breeding	IVT (E), AVT (E) -I P, AVT (E) - II P, AVT (E) -R, IVT (M), AVT (M) -I P, AVT (M) -II P, AVT (M) -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	NIL	ALL
10.	Uchani	Plant Breeding	IVT (M), AVT (M) -I P, AVT (M) -II P, AVT (M) -R	ALL	NIL
		Agronomy	AS 72, AS 73, AS 74, AS 75	AS 72, AS 74, AS 75	AS 73
		Plant Pathology	PP 14, PP14A, PP 17A, PP 17 B, PP 17D, PP 17F, PP 22, PP 23, PP 31, PP 33, PP 34	PP 14, PP14A, PP 17A, PP 17 B, PP 17D, PP 17F, PP 22, PP 23, PP 31, PP 33	PP 34

*Wild boar damage



Action Taken Report on the recommendations of the 33rd Biennial Workshop of AICRP on Sugarcane held at the ICAR-Indian Institute of Sugarcane Research, Lucknow during October 19 & 20, 2020

S. No.	Recommendation	Action Taken
1.	Monitoring of the ZVT trials during 2020 may be conducted online mode and the centres may make video footage of the trials clearly depicting the performance of the entries and standards. The team leader and members may evaluate the performance of the entries in comparison to the standards. (Action: All centres, Monitoring teams of all zones)	Monitoring of trials was done through virtual mode as per suggestions.
2.	Number of seedlings produced by the centres was about 6% of the potential seedlings that could be generated from the quantity of fluff supplied. Centres should take care in raising seedlings. (Action: All fluff supply programme participating centres)	The centres informed that care will be taken for production of seedlings.
3.	Some sugar mills are directly bringing varieties from foreign countries without regulatory approvals and introducing them to farmers without proper quarantine which may lead to disease epidemics. The centres should keep vigilant and inform such incidence to PC for further action. (Action: All centres and PC)	All the centres have been advised on this issue by the Project Coordinator(S)
4.	Proper MoU must be signed between the research centres and sugar mills before providing pre-release clones for evaluation which includes restriction of supply to farmers. (Action: All centres)	All the AICRP(S) centres have been informed on the subject. MoU is required to be signed before providing pre-release clones for evaluation.
5.	The parents in the National Hybridization Garden must be screened for prevailing races of red rot pathogen by the respective centres. This action to be completed within two years and the information may be provided to the ICAR-SBI for updating the database of NHG parents. The participating centres of the fluff supply programme must select one of the parents with resistance to red rot and or smut. (Action: All centres)	The action will be initiated to screen the parents for prevailing races of red rot pathogen by the centres. They have been also directed to provide information to ICAR-SBI, Coimbatore as suggested. Participating centres of the fluff supply programme have also been informed for selection of one of the parent with resistance to red rot and or smut.
6.	ICAR-SBI should help the participating centres in deciding the parents for 15 biparental cross combinations considering the breeding objectives. Parents should be selected for combining cane yield, juice quality, resistance to major pests and diseases and tolerance to abiotic stresses, ensuring parental diversity. (Action: ICAR-SBI, Coimbatore and All centres)	Accepted, the action will be taken as per guidelines provided by PI(CI), AICRP(S).
7.	SBI Coimbatore centre should conduct all the AICRP agronomy trials allotted under the Crop Production discipline. (Action: ICAR-SBI, Coimbatore)	Accepted by the SBI, Coimbatore.
8.	The severe incidence of red rot in the popular variety Co 0238 in most of the districts of Uttar Pradesh and Bihar need immediate attention for seed replacement. The new promising varieties with red rot resistance identified for the North West and North Central Zones are to be introduced in the affected locations. (Action: All centres)	Will be taken into consideration. The efforts have been made to develop new sugarcane varieties with better yield and disease resistance. Release of CoLk 14201 by the UP Govt. has become one important step in this direction to replace Co 0238.
9.	Healthy seed nursery programme must be intensified to manage the epidemic of red rot along with removal of severely affected varieties. Also, mechanized sett treatment with fungicides should be encouraged to reduce infection through seed and soil borne inoculum sources. (Action: All centres)	Instructions are required to be followed by the AICRP(S) centres under healthy seed nursery programme to manage the epidemic of severely affected varieties. The provision for funds is being made in EFC Memo (2021-26) for procurement of sett treatment device to all AICRP(S) centres.



MONITORING TEAMS FOR 2021-22 CROP SEASON

Monitoring Teams for different zones	Centres to be monitored
NORTH WEST ZONE	
Team Leader <ul style="list-style-type: none"> Dr. S.K. Pandey, Entomologist, SBI-RC, Karnal Member <ul style="list-style-type: none"> Dr. Gulzar S. Sanghera, Breeder, PAURRS, Kapurthala Dr. Sujeet Pratap Singh, Pathologist, UPCSR, Shahjahanpur Dr. V.P. Jaiswal, Agronomist, ICAR-IISR, Lucknow 	Lucknow, Shahjahanpur, Muzaffarnagar, Pantnagar, Karnal, Uchani, Kapurthala, Gurdaspur, Sriganaganagar and Kota
NORTH CENTRAL & NORTH EASTERN ZONE	
Team Leader <ul style="list-style-type: none"> Dr. S.K. Shukla, Agronomist, ICAR-IISR, Lucknow Member <ul style="list-style-type: none"> Dr. Kashinath Mandal, Breeder, SRS, Bethuadahari Dr. M. Minatullah, Pathologist, SRI, Pusa Dr. Vinay Mishra, Entomologist, GSSBRI, Seorahi 	Seorahi, Pusa, Motipur, Muzaffarpur, Bethuadahari and Buralikson
PENINSULAR ZONE I	
Team Leader <ul style="list-style-type: none"> Dr. A. Annadurai, Breeder, ICAR-SBI, Coimbatore Member <ul style="list-style-type: none"> Dr. S.N. Singh, Agronomist, ICAR-IISR, Lucknow Dr. Lalan Sharma, Pathologist, ICAR-IISR, Lucknow Dr. K.P. Salin, Entomologist, ICAR-SBI, Coimbatore 	Coimbatore, Pugalur, Thiruvalla, Mandya, Sankeshwar, Sameerwadi, Kolhapur and Perumalapalle
PENINSULAR ZONE II	
Team Leader <ul style="list-style-type: none"> Dr. S.B. Patil, Breeder, ARS, Sankeshwar Member <ul style="list-style-type: none"> Dr. Mona Nagargade, Agronomist, ICAR-IISR, Lucknow Dr. V.K. Biradar, Entomologist, SRS, Tharsa Shri B.H. Pawar, Pathologist, VSI, Pune 	Pune, Pravaranagar, Padegaon, Tharsa, Powarkheda, Navsari and Rudrur
EAST COAST ZONE	
Team Leader <ul style="list-style-type: none"> Dr. P.K. Nayak, Breeder, SRS, Nayagarh Member <ul style="list-style-type: none"> Dr. P. Kishore Verma, Pathologist, RARS, Anakapalle Dr. Arun Baitha, Entomologist, ICAR-IISR, Lucknow Dr. S.K. Yadav, Agronomist, ICAR-IISR, Lucknow 	Nellikuppam, Cuddalore, Vuyyuru, Anakapalle and Nayagarh

Facilitators of Monitoring Teams

Zone	Name & Designation	Contact details
North Central & North Eastern Zones	Shri Adil Zubair Chief Technical Officer	E-mail : adizubi64@gmail.com Mob. : 09451086378
Peninsular Zone-I	Dr. Lalan Sharma Scientist (Plant Pathologist)	E-mail : sharmabbaim@gmail.com Mob. : 08004081721; 08887960911 Facilitator-cum-Member
Peninsular Zone-II	Dr. G.K. Singh Chief Technical Officer	E-mail : gayakaraniisr@gmail.com Mob. : 9198848204
East Coast Zone	Dr. S.K. Yadav Scientist (Agronomy)	E-mail : sanjaybhu05@redifmail.com Mob. : 09402134428 Facilitator-cum-Member

Centre-wise funds released during 2020-21 of AICRP on Sugarcane

Table A: B.E. / R.E. sanctioned under AICRP (S) for the year 2020-21

(Rs. in lakh)

Sl. No.	Grant in Aid Component	Other than NEH	NEH	TSP	Total (2+3+4)
	1	2	3	4	5
Budget Estimates (B.E.)					
1.	Grant-in-aid-Salaries	689.00	63.30	-	752.30
2.	Grant-in-aid-General	145.00	20.00	35.00	200.00
Total		834.00	83.30	35.00	952.30
Revised Estimates (R.E.)					
1.	Grant-in-aid-Salaries	597.96	54.90	-	652.86
2.	Grant-in-aid-General	145.00	20.00	35.00	200.00
Total		742.96	74.90	35.00	852.86

Table B: Funds released to AICRP (S) centres during 2020-21

(Rs. in lakh)

Sl. No.	Name of centre	Pay & allow.	TA & contin.	Total (2+3)
	1	2	3	4
I. Regular centres				
1	Anakapalle (ANGRAU, Hyderabad)	47.23	6.75	53.98
2	Buralikson (AAU, Jorhat)	54.90	20.00	74.90
3	Cuddalore (TNAU, Coimbatore)	32.11	4.50	36.61
4	Faridkot (PAU, Ludhiana)	32.11	4.50	36.61
5	Kolhapur (MPKV, Rahuri)	32.11	4.50	36.61
6	Kota (MPUA&T Udaipur)	32.11	4.50	36.61
7	Kapurthala (PAU, Ludhiana)	32.11	4.50	36.61
8	Mandya (UAS, Bangalore)	32.11	4.50	36.61
9	Navsari, (NAU, Navsari)	31.72	4.50	36.22
10	Nayagarh (OUA&T, Bhubaneswar)	31.72	4.50	36.22
11	Padegaon (MPKV, Rahuri)	32.11	4.50	36.61
12	Pantnagar (GBPUA &T, Pantnagar)	31.34	4.50	35.84
13	Powarkheda (JNKVV, Jabalpur)	31.72	4.50	36.22
14	Pusa (RAU, Samastipur)	0.00	6.75	6.75
15	Sankeshwar (UAS, Dharwad)	30.81	4.50	35.31
16	Shahjahanpur (UPCSR, U.P.)	45.90	6.75	52.65
17	Sriganganagar (RAU, Bikaner)	31.34	4.50	35.84
18	Thiruvalla (KAU, Trichur)	46.30	6.75	53.05
19	Uchani (CCSHAU, Hisar)	45.11	6.75	51.86
Total		652.86	112.25	765.11
II. Voluntary centres (Funds released under contingencies)				
1	G.S. Sugarcane Breeding & Research Institute (UPCSR) Seorahi (U.P.)	-	5.00	5.00
2	Vasantdada Sugar Institute, Pune (M.S.)	-	5.00	5.00
3	Sugarcane Research Station, Vuyyuru, Distt. Krishna (A.P)	-	3.00	3.00
4	Sugarcane Research Station, Tharsa (M.S.)	-	3.00	3.00
5	Indira Gandhi Krishi Vishwavidyalaya, Kawardha, Distt. Raipur (Chhattisgarh).	-	3.00	3.00
TSP	RARS, Anakapalle, MSRS, Navsari, SRS, Nayagarh, SRS, Buralikson	-	35.00	35.00*
Total			54.00	54.00
Grand total (I + II)		652.86	166.25	819.11

*Rs 8.75 lakhs each centre.



Contact Details of Regular and Voluntary Centres Under AICRP (Sugarcane) in Different Zones

Name of Centre	Incharge / Address	Contact No./ E-mail
A. NORTH WEST ZONE		
1) Gurdaspur (recently shifted from Faridkot)	Dr. Dr. Bhupinder Singh Dhillon, Director, PAU Regional Research Station, Gurdaspur - 143521 (Punjab) (PAU, Ludhiana)	Phone No.: 01874-220825, 220703 Mob: 98555-56672 E-mail: directorrrsgurdaspur@pau.edu, associatedeanioagurdaspur@pau.edu
2) Kapurthala	Dr. Paramjit Singh, Director, PAU Regional Research Station, Kapurthala – 144 601(Punjab) (PAU, Ludhiana)	Mob: 098146-93189 E-mail: director-kapurthala@pau.edu; sangheragulzar@pau.edu (9872204523)
3) Karnal*	Dr S.K. Pandey, Pr. Scientist (Ento.) & Head, Sugarcane Breeding Institute Regional Centre, P.B.No. 52, Karnal (Haryana) – 132 001 (ICAR-SBI, Coimbatore)	Phone No.: 0184-2268096; Fax : 0184-2265723 Mob: 9355311525 E-mail: headsbirc@gmail.com; s_kantpandey@yahoo.com; sk_pandey@india.com
4) Shahjahanpur	Dr. J. Singh, Director, U.P. Council of Sugarcane Research, Shahjahanpur – 242 001	Phone No.: 05842-222509 / 222102 Mob: 094550-38993 Fax : 05842-222509 E-mail: dirupcsr@gmail.com; jyotsnendra@yahoo.com
5) Pantnagar	Dr Anand Singh Jeena, Deptt. of Genetics & Plant Breeding, G.B. Pant University of Agriculture & Technology, Pantnagar – 263 145, Distt. U.S. Nagar	Phone No.: 05944-233075; Fax : 05944-233473 Mob: 75002-41511 E-mail: dr.asjeena@gmail.com
6) Sriganaganagar	Dr. Subodh Bishnoi, Assistant Professor (Plant Physiology) & Incharge, Agricultural Research Station, Sriganaganagar – 335 001 (Rajasthan) (SKRAU, Rajasthan)	Phone No.: 0154-2440619; Fax : 0154-2440703 Mob: 8058626129 E-mail: bishnoisk@gmail.com
7) Muzaffarnagar*	Dr. Viresh Singh, Joint Director, Sugarcane Research Station (UPCSR), Muzaffarnagar– 252 001 (U.P.)	Phone/Fax No.: 0131-2621143 Mob: 87958-37163 E-mail: viresh63@gmail.com; osjoshia.upcsr@gmail.com
8) Kota	Dr. N.R. Koli, Assoc. Prof.(PB&G) & Project Incharge, Agricultural Research Station Ummedganj, P.B. No. 7, GPO – Nayapura, Kaithoon Road, Kota – 324 001 (Rajasthan) (AU, Kota)	Phone No.: 0744-2844369 (O); Fax : 0744-2844306 Mob: 094135-30031 E-mail: arskota@hotmail.com; nanag70@yahoo.co.in
9) Lucknow	Dr. A.D. Pathak, Director, ICAR -Indian Institute of Sugarcane Research, Rae Bareli Road, Lucknow – 226 0020	Phone No.: 0522-2480726; Fax : 0522-2480738 Mob: 094503-735650 E-mail: pathakashwani@rediffmail.com; director.sugarcane@icar.gov.in
10) Uchani	Dr. O.P. Chaudhary, Regional Director, Regional Research Station, (CCSHAU), Uchani – 132 001, Karnal (Haryana) (CCSHAU, Hisar)	Phone 0184-2267857; Fax : 0184-2267499 Mob: 94161-11775 E-mail: rrskarnal@hau.ac.in; rrsuchani@gmail.com

* Voluntary Centre



Name of Centre	Incharge / Address	Contact No./ E-mail
B. NORTH CENTRAL & NORTH EASTERN ZONE		
1) Seorahi*	Dr. Ved Prakash Singh, Scientific Officer & Incharge, G.S. Sugarcane Breeding & Research Institute, Seorahi, Distt. Kushinagar (U.P.)	Mob: 63890-25361 E-mail: gssbriseorahi@gmail.com
2) Pusa	The Dr A.K. Singh, Director, Sugarcane Research Institute (RAU), Pusa – 848 125, Distt. Samastipur (Bihar)	Phone No.: 06274-240221; Fax : 06274-240255 Mob: 9415920101; 6355707240 (Dr D.N. Kamat) E-mail: director.sri@rpcau.ac.in; kamatrau.pusa@gmail.com
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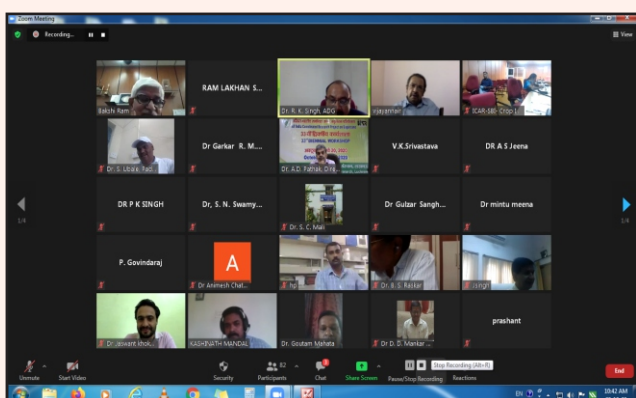
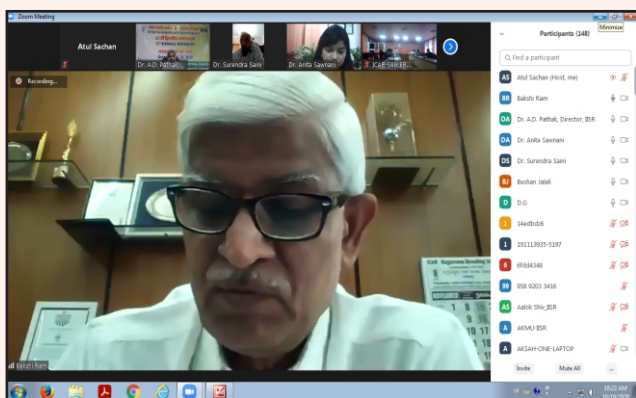
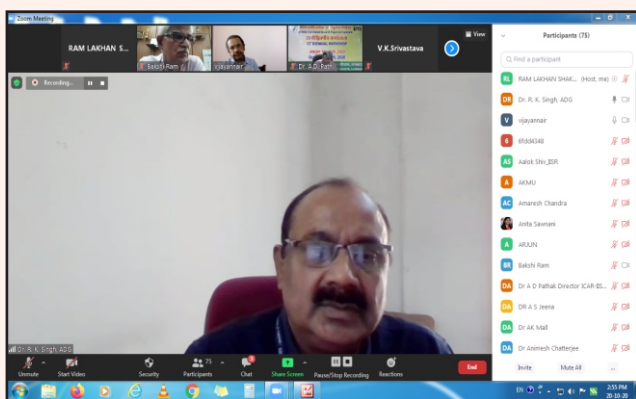
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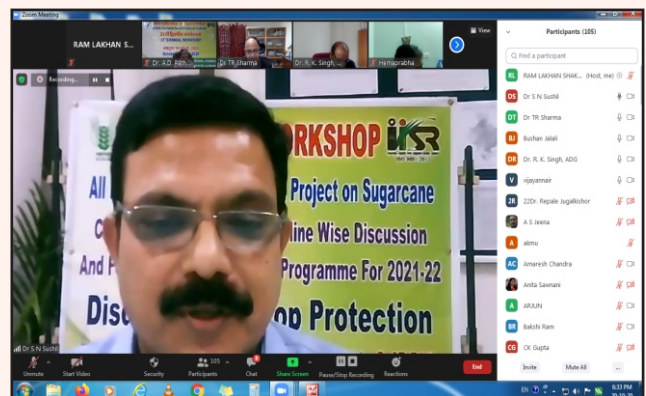
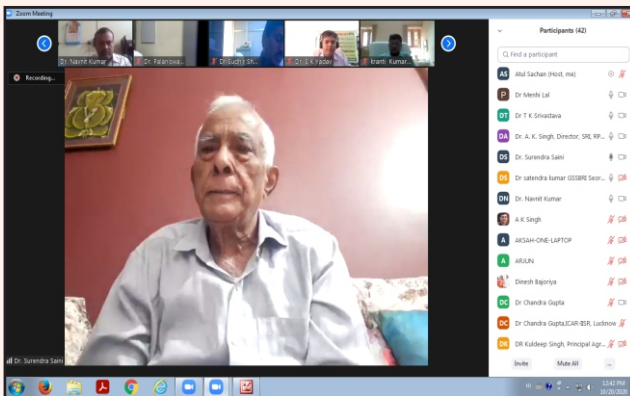
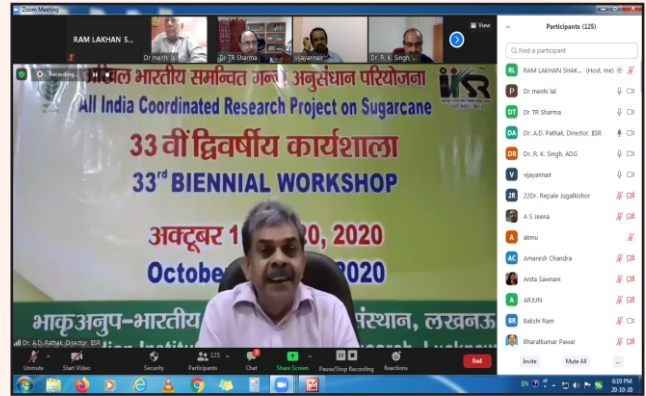
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Inaugural Session of 33rd Biennial Workshop on AICRP (S)





Plenary Session of 33rd Biennial Workshop - AICRP on Sugarcane



अखिल भारतीय समन्वित गन्ना अनुसंधान परियोजना
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