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वार्षिक प्रतिवेदन

Annual Report

2024

भा. कृ. अ. प. - गन्ना प्रजनन संस्थान
कोयंबत्तूर – 641 007

ICAR- SUGARCANE BREEDING INSTITUTE
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Preface

ICAR-Sugarcane Breeding Institute, Coimbatore is the major contributor of sugarcane varieties for the entire nation in the last century. The varieties developed by the institute are currently occupying 80.14% (4.41 million ha) of the total sugarcane planted areas of the country. The subtropical variety, Co 0238 (1.78 million ha) and tropical variety, Co 86032 (1.12 million ha) are the major varieties cultivated at present. However, in the last two years, sugarcane and sugar production in the country is declining owing to several reasons. Red rot infestation in the dominant variety of the subtropical region Co 0238, increased cost of cultivation, increased labour cost and non-availability of quality labour during the peak period of operations including harvesting and farmers shifting to other remunerative crops like banana, areca nut, maize, paddy, tapioca, climate change induced biotic stress like *Pokkah Boeng* and crown mealy bug in Tamil Nadu and Karnataka and unusual heavy flowering due to changed rainfall pattern in Maharashtra are the notable issues in sugarcane cultivation. The highest sugar production of 35.76 million tonnes was achieved during the year 2021-22 but the production came down to 31.5 million tonnes during the year 2023-24. During the current year 2024-25 also it is estimated that the production will be around 25.8 million tonnes excluding the 3.8 million tonnes of sugar diverted to ethanol production. In order to address these problems ICAR-SBI has taken several research initiatives.

The year 2024 was marked with significant achievements with the development of several technologies addressing the issues related to sugarcane cultivation. Co 17018, a midlate variety was released by CVRC and notified for cultivation in North West Zone consisting of Uttar Pradesh, Punjab, Haryana, Uttarakhand and Rajasthan. It recorded 91.48 t/ha of cane yield, 11.77 t/ha of sugar yield,18.38% of sucrose in juice and was moderately resistant to red rot.

Two genetic stocks *viz*., GU 12-19 (INGR 24050) and GU 12-21 (INGR 24049) involving *Erianthus procerus* were registered with ICAR NBPGR, New Delhi, wherein GU 12-19 was approved for excellent winter sprouting potential and red rot resistance and GU 12-21 for broad spectrum resistance to red rot disease and winter sprouting potential. The other genetic stock Co 12014 was registered with ICAR-NBPGR, New Delhi for combined resistance to red rot, smut and yellow leaf disease. All these genetic stocks were included in National Hybridization Garden (NHG) for making crosses. NHG, a national facility for making desired crosses was utilized by the 23 sugarcane breeding centres of the country and the centres made 441 biparental crosses and 20 poly crosses and 154 General collections. The world collection of germplasm totaling 3,379 clones at Kannur were maintained under disease and pest free conditions and 58 interspecific and intergeneric crosses involving *Saccharum officinarum*, *S. spontaneum*, *S. robustum*, *Erianthus* spp and sugarcane hybrids were made. At Coimbatore, 2,239 wild sugarcane germplasm accessions, 2,049 commercial clones and 229 genetic stocks were maintained and utilized in crossing programme. Forty-seven high altitude accessions collected from Arunachal Pradesh were maintained at Wellington and were utilized in the crossing programme for introgressing better winter sprouting. National Distant Hybridization Facility (NDHF) located at Agali, Kerala facilitated 21 fluff supply programme participating centres for making

105 ISH/IGH crosses. Identification of parents for introgressing climate resilient traits resulted in the selection of four *S. spontaneum* accessions *viz*., IND 04-1372, IND 99-847, IND 03-1307 and IND 03-1229 as promising drought tolerant genotypes and five *E. arundinaceus* accessions namely IND 99-889, IND 99-890, SES17, SES 79 and SES 206 exhibited high levels of tolerance against salt stress.

Production and supply of quality seed through Farmers Participatory Quality Seed Programme was successfully carried out in both tropical and subtropical regions. Around 1.5 lakh genetic fidelity tested and virus indexed tissue culture seedlings were distributed for breeder seed production. A total of 911 and 2,015 tonnes of quality seeds were produced and distributed to tropical and subtropical regions respectively. The impact of the tissue culture-based seed production has helped to manage red rot in Co 0238, a subtropical dominant variety which succumbed to red rot and to contain yellow leaf disease in Co 86032 in tropical region.

Under the AICRP(S) trials in two plant and one ratoon crops, Co 17001 and Co 17004 in Peninsular zone and Co 18022 in North West Zone were found to be performing better across the locations for cane yield and juice quality. Participatory Breeding program was initiated in collaboration with the sugar mills at the regional and national level. Under the Indian Sugar Millers and Manufacturers Association (ISMA) funded project, initial evaluation across 15 sugar mills in subtropical region identified Co 20016 and Co 21012 as the promising clones. Similar varietal trials in collaboration with the South Indian Sugar Mills Association (SISMA) has identified Co 19009 and Co 20011 as promising clones in the preliminary trial for Tamil Nadu.

Significant progress was made from studies pertaining to sugarcane genomics and molecular markers. EaPHT promoter isolated from *Erianthus* (Tripidium) *arundinaceus*, capable of directing high level constitutive expression of a target nucleotide sequence of interest in a plant has been certified as technology by ICAR. Sugarcane invertase inhibitors (ShINH1 and ShINH2) over-expressed transgenic lines were successfully developed. The event ShINH2-VT-5 showed the highest sucrose content of 20.37 % against untransformed controls Co 62175 (16.42 %) and Co 86032 (19.93 %).

Red fleshed *S. robustum* accession NG 77- 132 was consistently found to be free from INB incidence for five years at the field level and was identified as INB-resistant source for the pre-breeding programme. Whole genome sequencing of Bt isolates from Uttar Pradesh, Tripura and Western Ghats of Karnataka revealed the presence of novel cry toxin genes such as Cry8, Cry54 gene family, Cry70Aa and Cry70Ba crystal toxin gene. Studies on mechanization revealed that application of Bt—62 culture through Bio Formulation Applicator in sugarcane crop resulted in decreasing white grub population.

Weed control efficiency was higher in the pre-emergence application of Clomazone 30% + Sulfentrazone 28% WP (ready mix) 2.5 kg/ha followed by one inter-cultivation at 60 days after planting. Higher radiation use efficiency (Eu effy >2.0) and water use efficiency under water deficit conditions clones namely Co 85019, Co 14002, Co 15021, and Co 14025 were identified. The clones such as Baragua, CoS 8436, CoSe 95422, CoV 92102 and SES 594 remained resistant to most of the prevalent red rot isolates and may serve as sources of resistance to red rot.

Under the institute outreach programmes, 22nd Sugarcane Research & Development Workshop of Southern Karnataka in Mysuru was organised and a workshop on Management of Crown Mealy Bug and *Pokkah boeng* in Sugarcane was also conducted in association with Society for Sugarcane Research and Development (SSRD). Two Frontline Demonstrations on the newly released cane varieties viz., Co 11015 and Co 14012 and 21 one day training programmes for farmers and cane development personnel of the sugar mills were organized. Farm school on All India Radio was successfully conducted.

Two patents were granted to “Rapid treatment of planting materials of sugarcane and other vegetatively propagated crops” and “Vacuolar targeting determinants for plants and uses thereof”. In addition, a novel Bt isolate, Bt 41 was deposited as patent culture with International Deposit Authority at National Agriculturally Important Microbial Culture Collection, Mau, UP. Two copyrights were received for policy papers on Soil erosion status, priority treatment areas and conservation measures for different districts of Tami Nadu and Kerala. Fourteen technologies developed from the institute were certified by ICAR *viz*., eleven under SMD Crop Science and three under SMD-NRM. Around 10 MoUs have been signed for licensing of technologies developed from the Institute.

In addition to the research activities, institute also promoted education and 214 students completed internship training, and 19 students submitted dissertation towards post-graduation and two students completed Ph.D programme. Two major research facilities *viz*., *Ex-situ* conservation of wild sugarcane germplasm at Coimbatore and Micro-plots with rainout shelter at ICAR-SBIRC, Karnal were created to

strengthen the research activities. In addition, 250 seating capacity Sir T. S. Venkataraman *Sumadhuram* Hall was also inaugurated by the Secretary DARE and Director General, ICAR. At present 21.43 crores worth of external funded project are being carried out. Ten Institute scientists were deputed abroad for participation in trainings/conferences as well as to serve as experts under ITEC programme of Ministry of External Affairs, India. Institute has organised the International Society of Sugarcane Technologists (ISSCT) 13th Breeding and Germplasm and 10th Molecular Biology Workshop from July 8-12, 2024 and this was the first time that ISSCT workshop was organised in India. A total of 82 delegates including 39 scientists from major sugarcane growing areas attended the workshop.

Several Individual and team awards were received by the scientists of the institute from reputed research organisations. Many ICAR flagship programmes like Mera Gaon Mera Gaurav, Swachh Bharat were conducted successfully with great spirit.

I am immensely pleased to present the research activities and other accomplishment of the institute in this annual report. I wish to express my sincere thanks to all the scientists who have contributed significantly in the advancement of sugarcane research which not only helped the nation to sustain the sugarcane and sugar production but also meet out the future demand of sugar, alcohol, power and export for the Viksit Bharat 2047.

My thanks to the Chief Editor Dr. D. Puthira Prathap and other editorial committee members Dr. R Gopi, Dr. M. Alagupalamuthirsolai, Dr. T. Lakshmi Pathy & Smt. R. Nirmala for the meticulous compilation and editing of the annual report and prepared the report gorgeously. The constant encouragement and support received from Dr. Himanshu Pathak, Secretary DARE and Director General ICAR, Dr. T.R. Sharma, DDG (CS) upto January, 2024 and Dr. D.K. Yadava, Deputy Director General (Crop Science), Dr. Prasantha Kumar Dash, Assistant Director General (Commercial Crops) throughout the period is greatly acknowledged. I also thank Dr. G. Hemaprabha who served as Director, ICAR-Sugarcane Breeding Institute, Coimbatore till July, 2024.

P. GOVINDARAJ
Director
ICAR-SBI

03 कार्यकारी सारांश

वर्ष 2024 के दौरान संस्थान ने कई प्रभावशाली प्रौद्योगिकियां विकसित की गईं हैं और उनको किसानों, चीनी मिलों और उद्यमियों आदि हितधारकों तक प्रसारित किया गया हैं। को 17018, एक मध्य-देर से पकने वाली उच्च उपज वाली गन्ना किस्म है, जिसे एआईसीआरपी (गन्ना) की वैराइटी पहचान समिति द्वारा उत्तर पश्चिमी क्षेत्र के लिए पहचाना गया और वर्ष 2024 के दौरान सीवीआरसी द्वारा अधिसूचित किया गया। यह 109 जलवायु लचीली किस्मों में से एक थी, जिन्हें भारत के माननीय प्रधान मंत्री जी ने दिनांक 11.08.2024 को राष्ट्र को समर्पित किया था। बहु-तनाव सहिष्णु क्लोन, Co 12014, जिसमें लाल सड़न, स्मट और YLD (पीली पत्ती रोग) के प्रति प्रतिरोधिता सम्मिलित है, को पादप जर्मप्लाज्म पंजीकरण समिति (INGR 24051) द्वारा आनुवंशिक स्टॉक (संग्रह) के रूप में अनुमोदित किया गया। यह दो को-केन्स एवं दो उच्च गन्ना उपज (Co-20013) तथा रस में उच्च सुक्रोज प्रतिशत (को-23019) के आनुवंशिक स्टॉक (संग्रह) के जनक के रूप में भी प्रयुक्त हुआ जिसमें लाल सड़न और स्मट के प्रति प्रतिरोधिता भी शामिल है।

Co 24 श्रृंखला के कुल 19 Co केन चुने गए, जिनमें से 13 कोयम्बटूर में और छह करनाल केंद्र में पहचाने गए, और 15 क्लोन यानी Co 24001, Co 24002, Co 24003, Co 24004, Co 24005, Co 24009, Co 24010, Co 24011, Co 24012, Co 24016, Co 24017, Co 24018, Co 24019, Co 24020, Co 24021 को

एआईसीआरपी (एस) में आगे के परीक्षण के लिए बढ़ावा दिया गया। 2024 के क्रॉसिंग सीज़न (पुष्पन ऋतू) के दौरान एरोइंग प्लॉट में को कैन, आईएसएच, आईजीएच, सीवाईएम और विदेशी क्लोन का उपयोग करते हुए 223 द्वि-पैतृक क्रॉस, 44 पॉली-क्रॉस और 119 सामान्य संग्रह (जीसी) बनाए गए।

वर्ष 2024 के दौरान ग्राउंड नर्सरी में मूल्यांकन के लिए लगभग 65,000 पौधे रोपे गए। द्वि-पैतृक संकरण जिनमें Co 11015, Co 94008, Co 12014, Co 12009, Co 13014, Co 16018, Co 19009, CoVC 14061 और Co 86011 एक माता-पिता के रूप में शामिल थे उनसे बड़ी संख्या में संतति उत्पन्न हुई। पहले क्लोनल परीक्षण में, 320 क्लोनों में 240 दिनों में 20.0% से अधिक एचआर ब्रिक्स पाया गया, जो प्रारंभिक उच्च सुक्रोज संचय की उनकी क्षमता को दर्शाता है। Co 11015 को एक पैतृक के रूप में शामिल द्वि-पैतृक क्रॉस से प्राप्त संततियों ने 240 दिनों में उच्च एच.आर. ब्रिक्स मान दर्ज किया। द्वितीय क्लोनल

परीक्षणों से, उच्च उपज, गुणवत्ता, लाल सड़न प्रतिरोध और फील्ड स्टैंड (खेत में खडी फसल की दशा) को संयोजित करने वाले 273 क्लोनों का चयन किया गया और उन्हें पीजेडवीटी गुणन 2024 के लिए पदोन्नत किया गया। प्रीजेडवीटी 2024 में, क्लोन Co 24003 (22.43%), Co 24007 (22.18%), Co 24013 (22.63%) ने 12 महीनों में 22.00% से अधिक रस सुक्रोज दर्ज किया। **Co** गन्ना 24009 ने लाल सड़न और स्मट के प्रति आर/एमआर प्रदर्शित किया था, इसके अलावा कटाई के समय उच्च सुक्रोज प्रतिशत भी दर्ज किया गया था।

एआरटी परिक्षण वर्ष 2023-24 में, दो पौधों और एक पेड़ी फसल के संयुक्त विश्लेषण से पता चला कि गन्ना उपज और चीनी उपज के लिए वाणिज्यिक किस्म Co 86032 (140.28 टन/हेक्टेयर और 17.00 टन/हेक्टेयर) की तुलना में Co 15020 क्रमशः 14.50% और 19.06% सुधार के साथ सर्वश्रेष्ठ जीनोटाइप है। ऊर्जा गन्ना किस्म, एसबीआईईसी 14006, का लाइसेंस नवंबर 2024 के दौरान हृदय हाइड्रोजन पावर प्राइवेट लिमिटेड, पुणे को दिया गया।

कुल मिलाकर, कोयंबटूर में नव विकसित "आईसीएआर-एसबीआई जंगली गन्ना जर्मप्लाज्म भंडार" में 2277 गन्ना जर्मप्लाज्म अभिगम बनाए रखे गए, जिनमें *सैकरम स्पोंटेनियम* (1756), *एरिएंथस अरुंडिनेसियस* (233), *एरिएंथस एसपीपी* शामिल थे। (178), संबद्ध *जेनेरा* (62) और रेशा के लिए उन्नत *एरियनथस* (48)। अरुणाचल प्रदेश से एकत्रित 47 नमूनों को आईसीएआर-आईएआरआई क्षेत्रीय स्टेशन, वेलिंगटन में रख रखाव के लिए रखा गया। इसी प्रकार, 'को' कैन (**1280**), को एलाइड (16), विदेशी संकर (52), आईएसएच (**283**), आईजीएच (**37**), पीएल (58), सीडी (84), सीवाईएम (94), आईए (13), जीयू (1) और आईएनडी (6) सहित 1924 क्लोन राष्ट्रीय सक्रिय जर्मप्लाज्म बैंक में बनाए रखे गए थे। कुल 291 अधिसूचित किस्में और पंजीकृत आनुवंशिक स्टॉक बनाए रखे गए तथा 26 क्लोनों को सूचकांक संख्या प्रदान की गई। इसके अतिरिक्त, 'को' कैन, सह-संबद्ध क्लोन, विदेशी संकर, अंतर-विशिष्ट और अंतर-जेनेरिक संकर सहित 1394 जर्मप्लाज्म अभिगम, *सैकरम ऑफिसिनारम, एस. बारबेरी, एस. साइनेंस, एस. रोबस्टम, एरियनथस एसपीपी, स्क्लेरोस्टैचिया* और *नरेंगा* का सक्रिय संग्रह अगली केंद्र में बनाए रखा गया था।

एरिएंथस प्रोसेरस से संबंधित दो आनुवंशिक स्टॉक अर्थात जीयू 12-19 (आईएनजीआर 24050) और जीयू 12-21 (आईएनजीआर 24049) को आईसीएआर-एनबीपीजीआर, नई दिल्ली में पंजीकृत किया गया, जिसमें जीयू 12-19 को उत्कृष्ट शीतकालीन अंकुरण क्षमता और लाल सड़न प्रतिरोध के लिए अनुमोदित किया गया और जीयू 12-21 को लाल सड़न रोग के लिए व्यापक स्पेक्ट्रम प्रतिरोध और शीतकालीन अंकुरण क्षमता के लिए अनुमोदित किया गया। वर्ष 2024 में, *एस. स्पोंटेनियम* परिग्रहण अर्थात, IND 04-1372, IND 99-847, IND 03-1307 और IND 03-1229 को सूखा सहनशील जीनोटाइप के रूप में पहचाना गया, जबकि *ई. अरुंडिनेशियस* से संबंधित IND 99-889, IND 99-890, SES17, SES 79 और SES 206 ने नमक तनाव के प्रति उच्च स्तर की सहनशीलता प्रदर्शित की। *एस. स्पोंटेनियम* में साइटोलॉजिकल अध्ययन तथा *एरियन्थस* के फ्लोरल बायोलॉजिकल एवं साइटोलॉजिकल अध्ययन लक्षण-वर्णन का कार्य प्रगति पर है। *सैकरम* प्रजातियों में अध्ययन की गई कल्म (culm) शारीरिक रचना ने *एस. रोबस्टम* और *एस. स्पोंटेनियम* में अक्षुण्ण परिधीय संवहनी बंडलों का संकेत दिया, जबकि अन्य प्रजातियों में वे दूर-दूर व्यवस्थित थे। इन दोनों प्रजातियों में मध्यम और बड़े बंडलों की संख्या अधिक थी। *एस. साइनेंस* में बहुत छोटे परिधीय संवहनी बंडल थे, जबकि *एस. बारबेरी* में छोटे बंडलों की संख्या कम थी। मेरिस्टेम से प्राप्त अक्षीय कलिकाएं क्रायोप्रिजर्वेशन के लिए सबसे उपयुक्त पाई गईं। यद्यपि *एस. स्पोंटेनियम* क्लोन दीर्घकालिक भंडारण के तहत व्यवहार्य थे, लेकिन उनमें पुनर्जनन की क्षमता बहुत धीमी थी।

वर्ष 2023 के पुष्पन ऋतु के दौरान राष्ट्रीय संकरण उद्यान, कोयम्बटूर में निर्मित क्रॉस से उत्पादित 25.61 किलोग्राम वजन के फ्लफ को 23 फ्लफ प्राप्ति केन्द्रों को आपूर्ति किया गया। भा.कृ.अनु.प.-ग.प्र.सं. ने भाग लेने वाले केंद्रों को वर्ष 2024 में 441 द्वि-पैतृक क्रॉस बनाने में सुविधा प्रदान की। राष्ट्रीय दूरस्थ संकरण सुविधा, भा.कृ.अनु.प.-ग.प्र.सं. अनुसंधान केंद्र , अगली में, भाग लेने वाले 21 केंद्रों के लिए कुल 105 क्रॉस बनाए गए। इसके अतिरिक्त, केंद्र में आईसीएआर-एनआरसीबी से 750 पौधों की ऑफ-सीजन नर्सरी भी रखी जा रही है। डीयूएस परीक्षण के अंतर्गत, उष्णकटिबंधीय (कोयम्बटूर और अगाली) और उपोष्णकटिबंधीय केंद्र (करनाल) में पांच और चार किस्मों का परीक्षण किया गया, जो संदर्भ किस्मों से अलग पाई गईं।

एआईसीआरपी (एस) के अंतर्गत, एवीटी में दो पौधों और एक रेटून फसल के आधार पर कोयम्बटूर में प्रविष्टियों Co 17001 और Co 17004 ने बेहतर प्रदर्शन किया। आईवीटी में, **Co** 20005 और Co 20009 क्रमशः गन्ना उपज और सुक्रोज % के लिए तेईस प्रविष्टियों में सर्वश्रेष्ठ थे। करनाल में, Co 19017 और Co 18022 क्रमशः ए.वी.टी. I और ए.वी.टी. II में गन्ना उपज और सुक्रोज% के लिए सबसे अच्छी मध्य-देर प्रविष्टियाँ थीं, जबकि Co 20016 (अगेती) एवं Co 20017 (मध्यम देर) IVT में सर्वश्रेष्ठ थी।

स्वीट ब्लूम 2.0 के अंतर्गत, दो क्लोनों अर्थात Co 19009 और Co 20011 ने फसल के समय उपज और गुणवत्ता के मामले में Co 86032 से बेहतर प्रदर्शन किया। इसी प्रकार, भारत में विभिन्न कृषि-जलवायु परिस्थितियों के तहत वाणिज्यिक खेती के लिए स्थान-विशिष्ट गन्ना किस्मों की पहचान करने के लिए, आईसीएआर-एसबीआई और आईएसएमए (भारतीय चीनी मिल संघ) के बीच एक समझौता ज्ञापन पर हस्ताक्षर किए गए, जिसके तहत उष्णकटिबंधीय और उपोष्णकटिबंधीय क्षेत्रों में भाग लेने वाली चीनी मिलों को उत्कृष्ट क्लोनों के विभिन्न सेटों की आपूर्ति की गई। प्रारंभिक मूल्यांकन से पता चला कि नौ प्रविष्टियों में दो क्लोन अर्थात Co 20016 और Co 21012 उपोष्णकटिबंधीय क्षेत्र में चीनी मिलों में सर्वश्रेष्ठ थे।

वर्ष 2023-24 में किसान सहभागिता बीज उत्पादन कार्यक्रम के अंतर्गत सेयूर और नीलांबुर गांवों में 28.60 एकड़ भूमि पर बीज उत्पादन करने के लिए प्रगतिशील बीज किसानों का चयन किया गया है। फरवरी-अप्रैल, 2024 के दौरान सहकारी एवं निजी चीनी मिलों को लगभग 911.15 टन गुणवत्तायुक्त बीज की आपूर्ति की गई है। गुणवत्तापूर्ण गन्ना बीज सामग्री की आवश्यकता को पूरा करने के लिए, जुलाई-सितंबर, 2024 के दौरान कोयंबटूर और तिरुप्पुर जिलों में 35.98 एकड़ में रोपण किया गया। करनाल में कुल 25453.5 क्विंटल प्रजनक बीज का उत्पादन किया गया और उपोष्णकटिबंधीय क्षेत्र में विभिन्न गन्ना हितधारकों को आपूर्ति की गई।

गन्ना जीनोमिक्स और आणविक मार्करों से संबंधित अध्ययनों में महत्वपूर्ण प्रगति हुई। ट्रांसक्रिप्टोम डेटा से, सूखा सहनशील क्लोन AS 04-1687 में डीहाइड्रिन जीन को क्लोन किया गया, जिसके अनुक्रम लक्षण-वर्णन से 141 अमीनो एसिड के लिए कोड करने वाले ORF की उपस्थिति की पुष्टि हुई। होमो डोमेन ल्यूसीन जिपर (एचडीएलजेड) प्रतिलेखन कारक के प्रवर्धन के लिए एएस-04-1687 से जीनोमिक डीएनए को पृथक किया गया। ~3.0 केबी के प्रवर्धन उत्पाद को पीजेईटी वेक्टर में ब्लंट एंड क्लोनिंग रणनीति का उपयोग करके क्लोन किया गया। RNA को सूखे से प्रभावित AS-04-1687 से पृथक किया गया, सीडीएनए में परिवर्तित किया गया, तथा HDLZ के कोडिंग अनुक्रम के प्रवर्धन के लिए टेम्पलेट के रूप में उपयोग किया गया। इसके बाद 1.3 केबी आकार के प्रवर्धित उत्पाद को क्लोन किया गया और अनुक्रमण के लिए प्रस्तुत किया गया। 2डी-प्रोटिओमिक विश्लेषण और आगे MALDI-TOF के माध्यम से प्राप्त स्पॉट्स के विश्लेषण से 26.3 और 27 kDa (xyl I) के बाह्य कोशिकीय ज़ाइलेनस तथा 7.7 और 17.7 kDa (xyl II), हेमीसेल्यूलेज़ और पेक्टिनेज़ की पहचान की गई। अजैविक तनाव सहिष्णु और संवेदनशील क्लोनों के जीनोमिक डीएनए से GRAS 28 प्रतिलेखन कारक जीन को प्रवर्धित करने के लिए पांच प्राइमरों को डिजाइन किया गया था, जहां प्रवर्धित डीएनए बैंड ने R570 जीनोम के GRAS प्रतिलेखन कारक के साथ उच्च समानता दिखाई। गन्ने में अजैविक तनाव सहिष्णुता के लिए तुलनात्मक जीनोमिक्स और जैव सूचना विज्ञान उपकरणों का उपयोग करने के लिए, धान, ज्वार, मक्का और *अरेबिडोप्सिस* जैसी फसलों के सूखे और लवणता सहिष्णुता से संबंधित जीनों के प्रोटीन अनुक्रम का उपयोग करके गन्ने के प्रोटीन अनुक्रम के साथ संरेखण खोज की गई, और परिणामों ने ज्वार के जीन के साथ सबसे अधिक समानता दिखाई। *एरिएंथस (ट्रिपिडियम) अरुंडिनेसियस* से पृथक किए गए ईएपीएचटी प्रमोटर, जो किसी पौधे में रुचि के लक्ष्य न्यूक्लियोटाइड अनुक्रम की उच्च स्तरीय संवैधानिक अभिव्यक्ति को निर्देशित करने में सक्षम है, को आईसीएआर (आईसीएआर-सीएस-एसबीआई-टेक्नोलॉजी-2024-009) द्वारा प्रौद्योगिकी के रूप में प्रमाणित किया गया है। उच्च (Co 86032) और निम्न टिलरिंग जीनोटाइप (Co 99004) से टिलर नोड ऊतकों के मात्रात्मक प्रोटिओमिक्स विश्लेषण से 2,867 महत्वपूर्ण रूप से भिन्न प्रचुर मात्रा में प्रोटीन की पहचान की गई। गन्ना इन्वर्टेस अवरोधक (ShINH1 और ShINH2) अति-अभिव्यक्त ट्रांसजेनिक लाइनों को सफलतापूर्वक विकसित किया गया। ट्रांसजीन इवेंट ShINH2-VT-5 ने अपरिवर्तित नियंत्रण Co 62175 (16.42%) और Co 86032 (19.93%) के मुकाबले 20.37% की उच्चतम सुक्रोज सामग्री दिखाई।

करनाल में, तीन कैंडिडेट किस्मों - CoLk 15201, कोलख. 15207, और CoLk 15466 के लिए प्रथम वर्ष का डीयूएस (विशिष्टता, एकरूपता और स्थिरता) परीक्षण, Co 16030 के लिए दूसरे वर्ष के डीयूएस परीक्षण के साथ किया गया, और सभी चार उम्मीदवार संदर्भ किस्मों से भिन्न पाए गए। पॉट कल्चर में, सात जीनोटाइप (Co 20016, Co 17018, Co 18022, Co 98014, Co 22020, Co 21014 और Co 22021) ने नमी के तनाव के तहत उच्च संचयी जड़ की लंबाई, सतह क्षेत्र और जड़ आयतन दर्ज की।

कन्नूर में जर्मप्लाज्म अभिगम में पुष्पन 4.88% (*एस. ऑफिसिनारम*) से लेकर 95.38% (आईए संकर) तक था। परिणामस्वरूप, लाल रस वाले *एस. रोबस्टम* परिग्रहण एनजी 77-132 को क्षेत्र स्तर पर पांच वर्षों तक आईएनबी प्रकोप से मुक्त पाया गया तथा प्रजनन-पूर्व कार्यक्रम के लिए आईएनबी-प्रतिरोधी स्रोत के रूप में पहचाना गया।

मशीनीकरण पर किए गए अध्ययनों से पता चला है कि बायो फॉर्म्युलेशन एप्लीकेटर (जिसे पहले ईपीएन एप्लीकेटर के नाम से जाना जाता था) के माध्यम से गन्ने की फसल में बीटी-62 कल्चर के प्रयोग से सफेद ग्रब की आबादी में कमी आई है। मिनी ट्रैक्टर चालित गन्ना बोने की मशीन से गन्ने की रोपाई से समान गन्ना उपज (126.10 टन प्रति हैक्टर) दर्ज की गई, जबकि आईआईएसआर दो पंक्ति गहरे फरो गन्ना बोने की मशीन

(130.20 टन प्रति हैक्टर) और मैनुअल दो कली वाले सेट रोपण (116.50 टन प्रति हैक्टर) से गन्ने की रोपाई से उपज (116.50 टन प्रति हैक्टर) दर्ज की गई। मिनी ट्रैक्टर चालित गन्ना बोने की मशीन समय और श्रम की बचत में उपयोगी पाई गई।

दो पौधा और एक पेड़ी परीक्षणों में गन्ना जीनोटाइप, Co 17004 (180.10 t/ha) और CoVC 17061 (170.2 t/ha) के बाद Co 17001 (163.22 t/ha) ने मानक जांच किस्मों Co 86032 (156.85 t/ha), Co 09004 (155.90 t/ha) और CoC 671 (138.88 t/ha) की तुलना में काफी अधिक गन्ना उपज दर्ज की है। गन्ना क्लोन Co 18002, Co 18003, Co 18009, और Co 19008 ने लवणीय परिस्थितियों में बेहतर रूपात्मक-शारीरिक लक्षण प्रदर्शित किए। सक्रिय फास्फोरस के 0.8% पोटेशियम साल्ट (पीएसएपी) के घोल में गन्ने को भिगोने + आरडीएफ के 100% एन और 50% पी और के की मात्रा + 60, 80, 100 और 120 डीएपी के दौरान 0.4%, 0.65%, 1.0% और 1.10 पर पीएसएपी का पत्तियों पर छिड़काव करने से उच्च गन्ना उपज प्राप्त हुई। क्लोमाजोन 30% + सल्फेंट्राजोन 28% WP (तैयार मिश्रण) @ 2.5 किग्रा/हेक्टेयर की पूर्व-उद्भव अनुप्रयोग खरपतवार नियंत्रण दक्षता अधिक थी, जिसके बाद रोपण के 60 दिनों बाद एक अंतर-जुताई (आंशिक मिट्टी चढ़ाने से -72.36%) रही। ड्रिप सिंचाई (165.28 टन/हेक्टेयर) से गन्ने की उपज काफी अधिक थी, इसके बाद ट्रैश मल्चिंग (134.29 टन/हेक्टेयर) और स्किप फरो सिंचाई (130.79 टन/हेक्टेयर) से अच्छी उपज प्राप्त हुई । हालांकि, ट्रैश मल्चिंग और स्किप फरो सिंचाई किसानों के सिंचाई अनुसूची पद्धति के बराबर थे (131.89 टन / हेक्टेयर)।

सेल्यूलोज आधारित बायोमास विघटन के लिए श्वेत ग्रब की दो प्रजातियों, गन्ना इंटरनोड बोरर और लाल विविल पाम की आंत के माइक्रोफ्लोरा की संभावना विशेष रूप से गन्ना खोई से 2जी इथेनॉल उत्पादन के लिए संभावित स्रोतों के रूप में उपयोग के रूप में जांची गई। अट्ठाईस रूपात्मक रूप से अलग जीवाणुओं की सफलतापूर्वक पहचान की गई। इनमें से सोलह में महत्वपूर्ण सेल्यूलोलाइटिक गतिविधि देखी गई। आइसोलेट्स S4, C9 और I2 के लिए अधिकतम सेल्यूलोलिटिक सूचकांक मान क्रमशः 3.67, 3.25 और 1.00 थे। सी1 आइसोलेट्स ने 71.2% खोई विघटन की क्षमता को प्रदर्शित किया ।

विभिन्न नई पीढ़ी के खरपतवारनाशक अणुओं, ट्रैश मल्च अंतर-फसलों को शामिल करते हुए विभिन्न जुताई और खरपतवार प्रबंधन के प्रभाव पर अध्ययन से पता चला है कि बुआई के 180 दिन पर कुल खरपतवार की संख्या पारंपरिक जुताई (18.3 संख्या प्रति मीटर) में कम जुताई (13.1 संख्या प्रति मीटर) की तुलना में अधिक थी। एक अन्य प्रयोग में, विभिन्न खरपतवार प्रबंधन उपचारों में से, पूर्व-उद्भव पेंडिमेथालिन 38.7% सीएस @ 1.0 किग्रा ए.आई. प्रति हैक्टर + भूरे रंग की खाद के साथ ढेन्चा के उपरांत ट्रेश मल्चिंग @ 10 टन प्रति हैक्टर मेट्रिब्यूज़िन + 2,4-डी + पाइराज़ोसल्फ्यूरॉन इथाइल (तैयार मिश्रण) @ 3 किग्रा प्रति हैक्टर के प्रयोग से अंतिम मिट्टी चढ़ाने के बाद सबसे कम 9.2 संख्या प्रति हैक्टर खरपतवार संख्या दर्ज की गई। कम जुताई (18.1%) और मल्चिंग उपचार (15.9%) ने पारंपरिक जुताई (14.5%) और बिना मल्चिंग उपचार (13%) की तुलना में अधिक मिट्टी की नमी बरकरार रखी।

दस गन्ना संकर किस्मों की शारीरिक दक्षता का मूल्यांकन पूर्ण एवं अल्प सिंचाई स्थितियों में उनकी जल एवं विकिरण उपयोग दक्षता के आधार पर किया गया। क्लोन Co 85019, Co 14002, Co 15021, और Co 14025 ने उच्च विकिरण उपयोग दक्षता (Eu effy >2.0) और जल की कमी की स्थिति में जल उपयोग दक्षता दर्ज की। उष्णकटिबंधीय परिस्थितियों के लिए गन्ने में आइडियोटाइप अवधारणा विकसित करने के लिए पादप स्थापत्य गुणों पर किए गए अध्ययनों से पता चला है कि शीर्ष पर सीधी पत्तियों और निचली परत पर समतल पत्तियों वाले क्लोनों को प्रकाश संश्लेषण के प्रभावी उपयोग के लिए सौर विकिरण प्राप्त करने में लाभ होता है। टीवीडी पत्ती की मध्य-बिंदु ऊर्ध्वाधर ऊंचाई का को-गन्ने में गन्ना उपज के साथ सकारात्मक सहसंबंध था। फसल की प्रारंभिक अवस्था में कैनोपी कवर (%) ने सौर विकिरण के प्रभावी संचयन, अधिक बायोमास उत्पादन, तथा छाया द्वारा खरपतवार की वृद्धि को बाधित करने के अलावा सिंक विकास की दिशा में बढ़ावा दिया।

नियंत्रित परिस्थितियों में अजैविक तनाव की प्रतिक्रिया में गन्ना किस्म के मूल्यांकन के लिए हाइड्रोपोनिक स्क्रीनिंग पद्धति विकसित की गई। गन्ने में नमी की कमी के प्रभाव को कम करने के लिए पत्तियों पर छिड़काव करने से प्रारंभिक चरण के दौरान पत्तियों में बेहतर कोशिका झिल्ली स्थिरता, प्रकाश संश्लेषक रंगद्रव्य, संगत ऑस्मोलाइट्स, फेनोलिक सामग्री, स्टार्च, घुलनशील प्रोटीन सामग्री और एंटीऑक्सीडेंट एंजाइम बनाए रखने में सकारात्मक प्रतिक्रिया देखी गई, जिससे विकास और कटाई के चरणों के दौरान पत्तियों और डंठलों का बेहतर बायोमास बनाए रखने में मदद मिली। इन फार्मूलों की प्रभावकारिता से कटाई के समय असिंचित परिस्थितियों में मिल योग्य गन्नों की संख्या तथा गन्ने के वजन में उल्लेखनीय वृद्धि देखी गई।

वर्टिसोल में गन्ना पौध प्रत्यारोपण प्रौद्योगिकी (एसटीटी) का प्रदर्शन किया गया, जिसमें पौध की रोपाई (25-30 दिन पुरानी), पंक्तियों के बीच अधिक दूरी (1.5 मीटर x 0.6 मीटर), अंतरफसल, उपसतही ड्रिप सिंचाई, मृदा परीक्षण फसल प्रतिक्रिया पर आधारित उर्वरीकरण और मशीनीकरण शामिल थे। इस तकनीक से खेती की पारंपरिक विधि की तुलना में गन्ने की उपज में वृद्धि हुई। ड्रोन आधारित ऑप्टिकल चित्रों का उपयोग करके गन्ने में छत्र और बायोमास आकलन के लक्षण वर्णन से पता

चला कि डिजिटल छवि विश्लेषण से प्राप्त छत्र आवरण में रंग सूचकांकों के बीच बायोमास और एनडीआई मूल्यों के साथ r 0.82*** का बहुत उच्च सकारात्मक सहसंबंध था।

स्थलाकृतिक अनुक्रम में जलभराव वाली और अच्छी जल निकासी वाली मिट्टी में मृदा प्रोफ़ाइल अध्ययन से पता चला कि जलभराव वाली मिट्टी में सतह पर उच्च घनत्व (1.68) और कम हाइड्रोलिक चालकता (1.87 सेमी/घंटा) थी, जबकि अच्छी जल निकासी वाली मिट्टी में (क्रमशः 1.28 और 11.7 स्थूल घनत्व और हाइड्रोलिक चालकता के लिए) कम थी। चूनायुक्त मिट्टी में, बेसल डोज (आधारीय मात्रा) पर 50% फास्फोरस डीएपी के रूप में और रोपाई के 90 दिन बाद 50% फास्फोरस डीएपी के रूप में प्रयोग तथा बेसल पर 50% फास्फोरस एसएसपी के रूप में + रोपाई के 90 दिन पर 50% फास्फोरस डीएपी के रूप में प्रयोग करने से, बेसल डोज के रूप में संपूर्ण फास्फोरस के प्रयोग की तुलना में अधिक टिलर्स का उत्पादन हुआ।

गन्ने के रस के रासायनिक संरक्षण के साथ माइक्रोवेव हीटिंग के संयोजन से प्रशीतन में 21 दिनों से अधिक की संतोषजनक भंडारण स्थिरता प्राप्त हुई। गन्ने के रस से विभिन्न प्रकार की बर्फी तैयार करने की प्रक्रिया को मानकीकृत किया गया। प्रारंभिक रूप से, फ्रीज-सूखे तने के अर्क का इन विट्रो α-एमाइलेज अवरोधक और α-ग्लूकोसिडेस गतिविधियों के लिए विश्लेषण किया गया और पाया गया कि तने के अर्क में महत्वपूर्ण जैव सक्रियता है, जो चिकित्सीय भूमिका को इंगित करती है। कन्नूर में संवेदी मूल्यांकन के आधार पर गन्ना आधारित मूल्य संवर्धित उत्पादों में ज्वार आधारित हलवा सर्वोत्तम पाया गया तथा पैशन फ्रूट और तरल गुड़ का उपयोग करके तैयार किया गया स्क्वैश सबसे स्वादिष्ट पाया गया।

सीसीटी विधि के अंतर्गत, जांचे गए क्लोनों में से 580 क्लोन (18.26%) लाल सड़न संक्रमण से मुक्त थे तथा उन्हें प्रतिरोधी (आर) माना गया तथा 655 क्लोन (20.62%) को मध्यम प्रतिरोधी (एमआर) के रूप में वर्गीकृत किया गया तथा शेष क्लोनों को अतिसंवेदनशील (एस) या मध्यम अतिसंवेदनशील (एमएस) या अत्यधिक अतिसंवेदनशील (एचएस) के रूप में मूल्यांकित किया गया। संगरोध के अंतर्गत, राष्ट्रीय सक्रिय जर्मप्लाज्म (एनएजी) बैंक में शामिल करने के लिए 32 जीनोटाइप प्राप्त हुए और इनमें से केवल दो जीनोटाइप (उचानी से सीओएच 20261 और कन्नूर से जीयूके 14-48) कोयम्बटूर में स्थापित नहीं हो सके। शेष 30 जीनोटाइप को आईसीएआर-एसबीआई, कोयम्बटूर में एनएजी बैंक में शामिल करने की अनुमति दी गई। गन्ने में लाल सड़न, स्मट और अन्य प्रमुख कीटों के लिए आईवीटी और एवीटी क्लोनों का मूल्यांकन किया गया तथा प्रतिरोधी और सहनशील क्लोनों की पहचान की गई। कुल मिलाकर, टिश्यू कल्चर प्रयोगशाला, आईसीएआर-एसबीआई से 76 टिश्यू कल्चर पौधे प्राप्त हुए, ताकि जाँच किस्में जैसे कि **Co** 86032, **Co** 11015, **Co** 18009, और **Co** 14012 से गैर-फंगल रोगों की सूची बनाई जा सके। इनमें से, 82% और 15% टिश्यू कल्चर सामग्री क्रमशः एससीवाईएलवी और एससीजीएस फाइटोप्लाज्मा से मुक्त थी। सीएफ ईपीएल1-पीआर1 कॉम्प्लेक्स की स्थिरता और गतिशीलता को आणविक गतिशीलता सिमुलेशन द्वारा मान्य किया गया था, जो कि गन्ने और *कोलेटोट्राईकम फाल्केटम* इंटरैक्शन के दौरान इंटरैक्टिंग भागीदारों की पहचान करने के लिए एक प्रस्तावना के रूप में था। गन्ने और अन्य वानस्पतिक रूप से प्रचारित फसलों जैसे कि ग्लेडियोलस, गुलदाउदी, रजनीगंधा, क्रोसैंड्रा और केले की सेट ट्रीटमेंट डिवाइस (एसटीडी) में मशीनीकृत प्राइमिंग में, रसायनों, जैव नियंत्रण एजेंटों और उर्वरकों का अकेले या संयोजन में उपयोग करने से प्रभावी रूप से विल्ट की घटना को नियंत्रित किया गया, साथ ही पौधों के अंकुरण और वृद्धि में भी सुधार हुआ। एस.टी.डी. यंत्र का उपयोग करते हुए 54 डिग्री सेल्सियस पर गर्म पानी के उपचार से भी संक्रमित हल्दी प्रकंदों में घाव सूत्रकृमि की आबादी में उल्लेखनीय कमी आई। फाइटोप्लाज्मा और मेज़बान (होस्ट) के बीच परस्पर क्रिया से संबंधित एक अध्ययन में, गन्ने के सभी भागों में फाइटोप्लाज्मा की उपस्थिति प्रणालीगत रूप से स्थापित की गई। एससीजीएस फाइटोप्लाज्मा के संपूर्ण जीनोम खनन से 404 प्रोटीन-कोडिंग जीन का पता चला, जिनमें से लगभग 7.5-8.2% को विषैले प्रोटीन/प्रभावक के रूप में पहचाना गया। विकास को बढ़ावा देने और विरोधी गुणों के लिए विभिन्न एंडोफाइटिक बैक्टीरिया और राइजोस्फीयर उपनिवेशी सूक्ष्मजीवों का अध्ययन किया गया। कई अमोनिया उत्पादन, फॉस्फोरस (P) घुलनशीलता, जिंक (Zn) घुलनशीलता, साइडरोफोर उत्पादन और IAA उत्पादन के लिए सकारात्मक थे और कई बैक्टीरिया ने इन विट्रो में क्रमशः *कोलेटोट्राईकम फाल्केटम* और *फ्यूजेरियम सैकेरी* के विकास को दृढ़ता से बाधित किया। तेरह नामित *सी. फाल्केटम* पैथोटाइप (सीएफ 01 से सीएफ13) का लक्षण-निर्धारण किया गया तथा दो मॉर्फोटाइप की पहचान की गई। छह जीनों का उपयोग करके *सी. फाल्केटम* के मल्टी लोकस सीक्वेंस टाइपिंग (एमएलएसटी) के प्रारंभिक अध्ययन में कुछ जीनों में अनुक्रमों में मामूली भिन्नता का संकेत मिला। लाल सड़न रोग के पृथक समूह Cf11015 (तिरुवेंदीपुरम) और Cf11015 (पेरियासेवलाई) अन्य परीक्षणित पृथक समूहों की तुलना में तुलनात्मक रूप से अधिक विषैले थे। बारागुआ, CoS 8436, CoSe 95422, CoV 92102 और SES 594 जैसे क्लोन अधिकांश परीक्षण किए गए पृथक्कों के प्रति प्रतिरोधी बने रहे। बीओ 91 और खाकाई कई आइसोलेट्स के विरुद्ध मध्यवर्ती प्रतिक्रिया (एमएस) दिखा रहे थे।

उत्तर प्रदेश, त्रिपुरा और कर्नाटक के पश्चिमी घाटों से बीटी पृथकों के संपूर्ण जीनोम अनुक्रमण से क्राई 8, क्राई 54 जीन परिवार, क्राई 70 एए और क्राई 70 बीए क्रिस्टल टॉक्सिन जीन जैसे नवीन

क्राई टॉक्सिन जीन की उपस्थिति का पता चला। सीएचएसए जीन, जो मोल्टिंग प्रक्रिया के दौरान काइटिन के संश्लेषण के लिए अपरिहार्य है, को ईएसबी और आईएनबी दोनों में आरएनएआई के लिए उपयुक्त उम्मीदवार के रूप में पहचाना गया है। इंटरनोड बोरर के परजीवी *टेलेनोमस डिग्रस* और *कोटेसिया फ्लेवीप्स* के लिए विभिन्न द्रव्यमान गुणन विधियों को मानकीकृत किया गया। विभिन्न मात्राओं और आवृत्ति पर परजीवी के साथ किए गए क्षेत्र परीक्षणों से *कोटेसिया फ्लेवीप्स* और *टेलीनोमस* के लिए रिलीज प्लॉट में उच्च परजीवी रिकवरी के साक्ष्य मिले, जिन्हें 1000 परजीवी/हेक्टेयर के बराबर मात्रा पर रिलीज किया गया था, नियंत्रण प्लॉट में आईएनबी के स्तर में वृद्धि के विपरीत रिलीज के बाद आईएनबी का स्तर कम हो गया था। गन्ने की अंतरजातीय संकर प्रजातियों में प्रतिरोध की प्रारंभिक पहचान तंत्र के अध्ययन में, सहनशील (टी) और मध्यम सहनशील (एमटी) जीनोटाइप की पहचान की गई। नौ सहिष्णु जीनोटाइप, अर्थात्, जीयू 19-4, जीयू 19-7, जीयू 19-27, जीयू 19-28, जीयू 19-60, जीयू 19-61, जीयू 19-72, जीयू 19-78 और जीयू 19-85 में <5% ईएसबी घटना दर्ज की गई। आईएनबी संक्रमण के बावजूद, आईजीएच क्लोनों, जैसे जीयू 19-4, जीयू 19-10, जीयू 19-24, जीयू 19-22, जीयू 19-38, जीयू 19-39, जीयू 19-43, जीयू 19-55, जीयू 19-77, और जीयू 19-85 तथा एसबीआईईसी 13010 और एसबीआईईसी 14006 ऊर्जा कैन में में भी इंटरनोड लंबाई या परिधि में कोई महत्वपूर्ण कमी नहीं पाई गई। । डी.यू.एस. और एन.ए.जी. संग्रहों में रखे गए कुल 291 क्लोनों की *पी. सैकरिफोली* के प्रति प्रतिक्रिया के लिए जांच की गई। इनमें से 27 क्लोन दोनों फसल मौसमों में मिलीबग के प्रकोप से मुक्त रहे। टाइप II ऊर्जा गन्ना एसबीआईईसी 11004 उन क्लोनों में से एक था, जो मिलीबग के प्रकोप से मुक्त पाया गया। मूल्यांकित दानेदार कीटनाशकों में, कार्टाप हाइड्रोक्लोराइड 4% जीआर, थायमेथोक्सम 1% + क्लोरएन्ट्रानिलिप्रोएल 0.5% और कार्बोफ्यूरान 3% सीजी को दो अनुप्रयोगों के बाद नियंत्रण की तुलना में 85% से अधिक की कमी के साथ बेहतर पाया गया। गन्ना बोरर्स के पसंदीदा आहार स्थलों पर सिलिकॉन की प्रोफाइलिंग से पता चला कि टाइप II ऊर्जा गन्ना एसबीआईईसी 14006 के सभी भागों में सिलिकॉन की मात्रा सबसे अधिक थी, उसके बाद एसबीआईईसी 11004 और एसबीआईईसी 11001 थे और अध्ययन की गई किस्मों में, पत्ती आवरण और छिलके में सिलिकॉन की मात्रा सबसे अधिक किस्म **Co** 06030 में थी, उसके बाद **Co** 06022 और **Co** 0238 किस्मों में थी ।

चार *स्टीनेरनेमा एसपीपी* (*स्टीनेरनेमा सुरखेटेन्से* एसबीआईपी3, *एस. थर्मोफिलम* एसबीआईएच1, *एस. सियामकाई* एसबीआईटीएनटी1, *स्टीनेरनेमा एसपीपी.* एसबीआईयूपी96) का द्रव मीडिया का उपयोग करके बड़े पैमाने पर सफल उत्पादन किया गया। दो ईपीएन आइसोलेट्स (*एस. सुरखेटेन्से* एसबीआईपी 3 और *एस. सियामकाई* एसबीआईटीएनटी 1) को *इन विट्रो* और *इन विवो* में संवर्धित करके *गैलेरिया मेलोनेला* लार्वा के विरुद्ध विभिन्न मात्राओं और मृत्यु दर के साथ परीक्षण किया गया, जो 60 से 100% के बीच थी। अठहत्तर ईपीएन उपभेदों [उष्णकटिबंधीय (49) और उपोष्णकटिबंधीय (29)] को संस्कृति संग्रह में बनाए रखा गया था और *फोटोरहैबडस एसपीपी* से संबंधित 45 सहजीवी बैक्टीरिया थे। (26 संख्या) और *ज़ेनोरहैबडस एसपीपी.* (19 संख्या) को भी ग्लिसरीन में रखा गया था।

संस्थान ने 20-21 जून 2024 के दौरान मैसूर में दक्षिणी कर्नाटक की 22वीं गन्ना अनुसंधान एवं विकास कार्यशाला का आयोजन किया था, जिसकी मेजबानी कोरोमंडल शुगर्स लिमिटेड, मकावल्ली और एस.निजलिंगप्पा शुगर इंस्टीट्यूट, बेलगावी के एम. विश्वेश्वरैया गन्ना अनुसंधान केंद्र, मंड्या ने संयुक्त रूप से की थी। इस कार्यक्रम में 250 से अधिक प्रतिनिधियों ने भाग लिया। 'सूखे का प्रबंधन और सिंचाई जल उपयोग दक्षता में सुधार के उपाय' तथा 'दक्षिणी कर्नाटक में गन्ना पैदावार में सुधार के लिए हस्तक्षेप' जैसे विषयों पर चर्चा की गई।

संस्थान द्वारा अनुसंधान निष्कर्षों के प्रसार के लिए आईएसएससीटी (अंतर्राष्ट्रीय गन्ना प्रौद्योगिकीविद सोसायटी) की 13 वीं प्रजनन एवं जर्मप्लाज्म कार्यशाला और 10 वीं आणविक जीव विज्ञान कार्यशाला तथा शीतकालीन स्कूल का "भारत में खाद्य एवं ऊर्जा सुरक्षा के लिए जलवायु स्मार्ट गन्ना कृषि" विषय पर आयोजन किया गया।

संस्थान में गन्ना आधारित कृषि-व्यवसाय इनक्यूबेटर शुगरकेनएज ने पायलट पैमाने पर उत्पादन और नवीन खाद्य उत्पादों के विकास के लिए कई उपकरण स्थापित किए हैं, जिनमें वैक्यूम ओवन, ट्रे ड्रायर, एचपीएलसी कॉलम, वाइन रिफ्रैक्टोमीटर और अन्य छोटे उपकरण शामिल हैं। दो वर्षों में तीन फसलों की खेती की तकनीकी व्यवहार्यता और आर्थिक व्यवहार्यता तथा जल संरक्षण पर मृदा नमी सूचक (एसएमआई) के प्रभाव का अध्ययन करने के लिए किस्म **Co** 11015 पर डेटा एकत्र किया गया। एसएमआई उपयोगकर्ताओं ने बताया कि वे प्रति फसल चक्र एसएमआई के उपयोग के कारण सिंचाई की बचत कर सकते हैं। फसल विज्ञान डेटा के विश्लेषण के लिए एक विशेषज्ञ सॉफ्टवेयर प्रणाली विकसित करने के प्रयास में, संस्थान के वैज्ञानिक कर्मचारियों, विशेष रूप से प्रजनन इकाई से, सांख्यिकीय उपकरणों के लिए उनकी आवश्यकताओं के संबंध में जानकारी एकत्र की गई।

हाल के महीनों में, तमिलनाडु के कुछ जिलों में गन्ने में क्राउन मीली बग (सीएमबी) और पोक्काह बोएंग (पीबी) के प्रकोप की खबरें बढ़ रही हैं। इसे देखते हुए, संस्थान ने नवंबर 2024 के दौरान विल्लुपुरम, कुड्डालोर, कल्लाकुरिची, अरियालुर,

पेरम्बलुर, नामक्कल, तंजावुर, तिरुचिरापल्ली, तिरुवन्नामलाई, धर्मपुरी और इरोड जिलों से संबंधित गन्ना विकास कर्मियों के लाभ के लिए सोसायटी फॉर शुगरकेन रिसर्च एंड डेवलपमेंट (एसएसआरडी) के सहयोग से 'गन्ने में क्राउन मीली बग और पोक्का बोएंग के प्रबंधन पर कार्यशाला' का आयोजन किया।

तमिलनाडु के तिरुवन्नामलाई (उत्तर पूर्वी कृषि जलवायु क्षेत्र) और इरोड (पश्चिमी कृषि जलवायु क्षेत्र) जिलों में नई जारी की गई गन्ना किस्मों, अर्थात् Co 11015 और Co 14012 पर दो अग्रिम पंक्ति प्रदर्शन आयोजित किए गए। दोनों क्षेत्रों में प्रक्षेत्र दिवस (फील्ड डे) आयोजित किए गए, जिसमें बड़ी संख्या में गन्ना किसानों और गन्ना विकास कर्मियों ने भाग लिया।

संस्थान ने कोयम्बटूर में 733 प्रशिक्षुओं के साथ 21 एक दिवसीय प्रशिक्षण कार्यक्रम आयोजित किए, 123 एक्सपोजर दौरे आयोजित किए, जिनसे 8932 छात्र/शिक्षाविद लाभान्वित हुए तथा 53 व्यक्तिगत परामर्शों की व्यवस्था की गई, जिससे 134 गन्ना किसान लाभान्वित हुए। करनाल में "उपोष्णकटिबंधीय भारत में टिकाऊ गन्ना खेती" पर एक विचार मंथन सत्र सह प्रशिक्षण और ऑफ-कैंपस / ऑन-कैंपस एक दिवसीय प्रशिक्षण आयोजित किया गया।

संस्थान ने गन्ना किसानों को गन्ने की वैज्ञानिक विधि पर नवीनतम तकनीकी ज्ञान और जानकारी प्राप्त करने के लाभ के लिए 13 कक्षाओं के साथ 'समृद्धि के लिए गन्ना खेती' पर 'आकाशवाणी पर फार्म स्कूल' शुरू किया। संस्थान ने महाराष्ट्र और आंध्र प्रदेश के किसानों के लिए गन्ना उत्पादकता में सुधार लाने पर तीन प्रायोजित प्रशिक्षण कार्यक्रम भी आयोजित किए।

संस्थान ने राष्ट्रव्यापी अभियान "विकसित भारत संकल्प यात्रा" में सक्रिय रूप से भाग लिया। कुल मिलाकर, संस्थान के 46 कर्मचारियों ने तमिलनाडु के पांच जिलों शिवगंगा, विल्लुपुरम, तिरुप्पुर, विरुधुनगर और तिरुवन्नामलाई के किसानों के बीच विभिन्न सरकारी योजनाओं के बारे में जागरूकता बढ़ाने के लिए 1031 ग्राम पंचायतों को कवर किया।

तमिलनाडु राज्य ग्रामीण आजीविका मिशन, सेलम के अनुरोध पर, डीएपीएसटीसी (अनुसूचित जनजाति घटक के लिए विकास कार्य योजना) को तमिलनाडु के सेलम जिले में पूर्वी घाट (चिन्ना कालरायन पहाड़ियों) के पांच गांवों में लागू किया गया। इनमें से दो जनजातीय बस्तियों मोलयानूर और विलमपट्टू के आदिवासियों के लिए वैज्ञानिक गन्ना खेती पर प्रशिक्षण अभियान चलाए गए। इस परियोजना के प्रभाव को प्रिंट और इलेक्ट्रॉनिक मीडिया में व्यापक रूप से कवर किया गया।

आईटीएमयू ने संस्थान की समग्र बौद्धिक संपदा और व्यावसायीकरण गतिविधियों का समन्वय किया। पीपीवी एवं एफआरए से पांच किस्मों के लिए पंजीकरण प्रमाण पत्र प्राप्त हुए। दो पेटेंट और एक डिज़ाइन पेटेंट प्रदान किया गया। विदेशी देशों को विभिन्न किस्मों और ऊर्जा गन्ने के निर्यात से संबंधित चार एनबीए फॉर्म 2 आवेदन प्रस्तुत किए गए। लाइसेंस प्राप्त मृदा नमी सूचक प्रौद्योगिकी, ऊर्जा गन्ना (एसबीआईईसी 14006) और आईसीएआर-एसबीआई ईपीएन जैव कीटनाशक निर्माण, गन्ने से गन्ना जैम का उत्पादन।

संस्थान के दो छात्रों को भारथिअर विश्वविद्यालय, कोयम्बटूर द्वारा पीएचडी की उपाधि प्रदान की गई। कुल मिलाकर, 214 छात्रों ने इंटर्नशिप की थी, जबकि 19 ने संस्थान में स्नातकोत्तर की पढ़ाई के लिए अपना अनिवार्य प्रोजेक्ट कार्य पूरा कर लिया था। कुल मिलाकर, डीबीटी, डीएसटी-एसईआरबी और अन्य सरकारी स्रोतों द्वारा संस्थान के लिए रु. 338.436 लाख के परिव्यय के साथ छह बाहरी वित्त पोषित परियोजनाएं मंजूर की गईं। संस्थान के दस वैज्ञानिकों को प्रशिक्षण/सम्मेलनों में भाग लेने के साथ-साथ विदेश मंत्रालय, भारत के आईटीईसी कार्यक्रम के अंतर्गत विशेषज्ञ के रूप में कार्य करने के लिए विदेश में नियुक्त किया गया।

नई सुविधाएं जैसे जंगली गन्ना जर्मप्लाज्म के संरक्षण के लिए एक्स-सीटू सुविधा, सर टी.एस. वेंकटरमन सुमाधुरम हॉल, एक अत्याधुनिक ऑडिटोरियम कोयम्बटूर में तथा करनाल में वर्षा से बचने के लिए रेन आउट शेल्टर के साथ माइक्रोप्लाट बनाए गए।

संस्थान के वैज्ञानिकों को उनके संबंधित अनुसंधान क्षेत्रों में योगदान के लिए पुरस्कारों जैसे इंडियन सोसाइटी फॉर प्लांट फिजियोलॉजी से आर.एच. दस्तूर गोल्ड मेडल अवार्ड 2024, साउथ इंडियन शुगरकेन एंड शुगर टेक्नोलॉजिस्ट्स एसोसिएशन (एसआईएसएसटीए) से पुष्पावती ब्लेसिंग गरपति गोल्ड मेडल, एसएसआरपी (सोसाइटी फॉर शुगर रिसर्च एंड प्रमोशन) फेलोशिप अवार्ड-2024, 'गन्ने में उत्कृष्ट अनुसंधान' के लिए सर टी.एस. वेंकटरमन द्विवार्षिक पुरस्कार और तमिलनाडु राज्य विज्ञान और प्रौद्योगिकी परिषद से तमिलनाडु वैज्ञानिक पुरस्कार (टीएएनएसए) तमिलनाडु सरकार आदि द्वारा सम्मानित किया गया।

02

Overview

Background

ICAR- Sugarcane Breeding Institute (SBI), Coimbatore has been conducting research on various aspects of sugarcane agriculture and varietal improvement since its inception in 1912. The Institute has developed nearly 4000 'Co' selections, many of them becoming popular as commercial varieties in different parts of the country. 'Co' canes bred at SBI along with the varieties identified from the crosses made at the institute by the State Sugarcane Research Stations occupy nearly 95% of the cane area in the country. Thus, the sugarcane varieties cultivated in the country today are directly or indirectly derived from this institute. Co canes were successful as commercial varieties in over 28 countries at one time and are being extensively used as parents in breeding programmes even today. The Institute maintains one of the largest collections of sugarcane genetic resources in the world.

Location

The Institute is located 8 km from the Coimbatore railway station and 19 km from the Coimbatore airport. Geographically it is located at 77^0E longitude and 11^0N latitude at an altitude of 427 m above mean sea level.

Centres

The Institute has one Regional Centre at Karnal (Haryana) and two Research Centres at Kannur and Agali (Kerala).

Mandate

- To breed superior sugarcane varieties / genotypes having high sugar productivity as well as sustainability and to assist State sugarcane breeding programmes.
- To collect, maintain, evaluate, document and conserve sugarcane genetic resources.
- To conduct basic and strategic research on crop improvement, production and protection aspects of sugarcane cultivation.
- To effect technology transfer, consultancy and human resource development in the area of sugarcane agricultural research

Staff Position

Staff Position as on 31 December 2024

S. No.	Category	Sanctioned	Filled	Vacant
1.	RMP	1	1	-
2.	Scientific	77	69	8
3.	Technical	71	46	25
4.	Administration	43	22	21
5.	Supporting	56	45	11
	Total	**248**	**183**	**65**

Financial Statement

Abstract of expenditure during 2023-24

Head	Amount in Lakhs (Rs. in lakhs)
Government Grant	6207.09
Government Grant Schemes	33.47
Externally Funded Schemes	972.13
Contract research projects (CRP)	13.75
Total	**7226.44**

Organizational Set-up

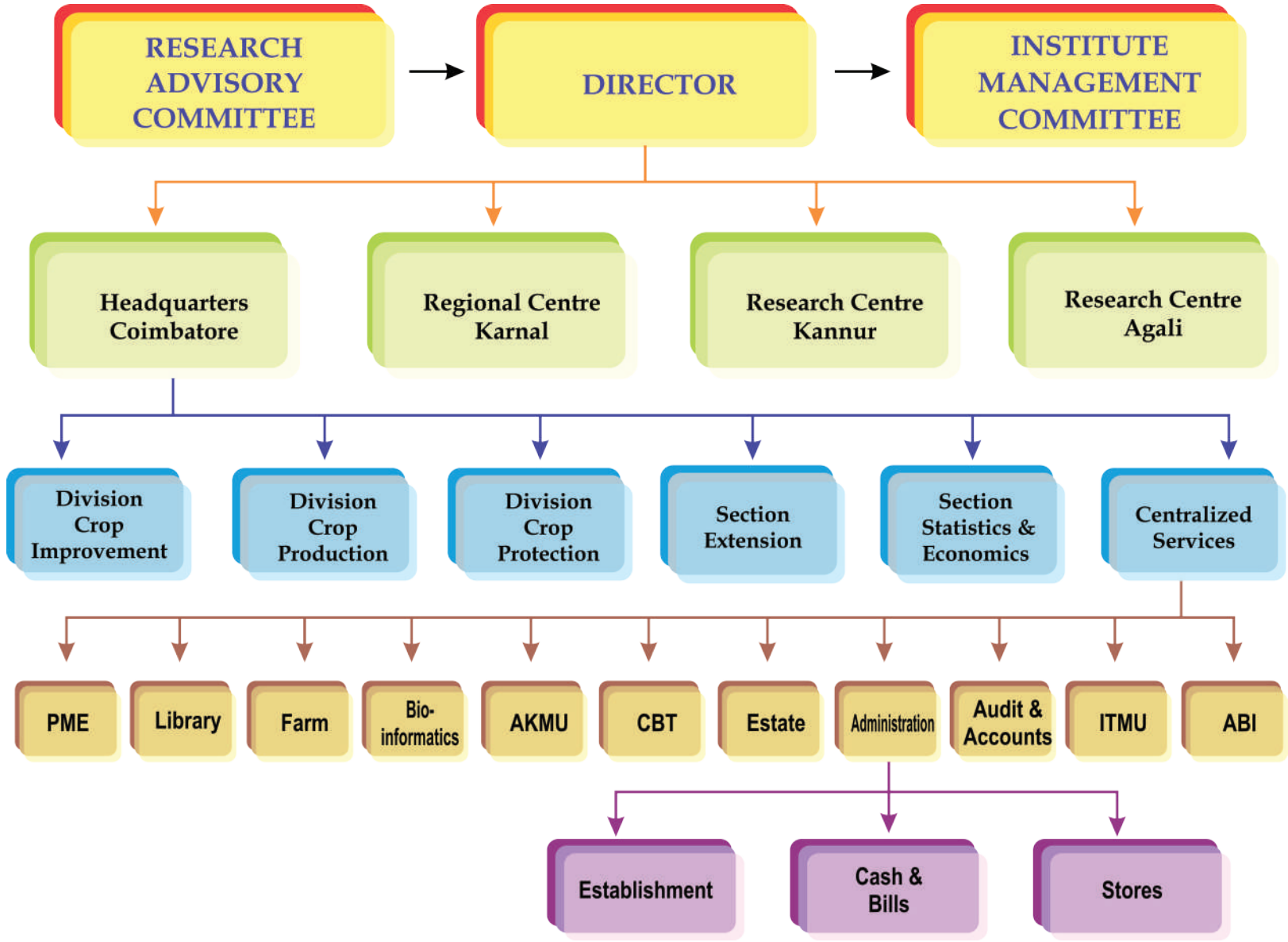
The research activities of the Institute are being carried out in three divisions and two sections at the main Institute and its Regional / Research Centres under the administrative control of the Director. The Prioritization, Monitoring and Evaluation Unit supports the research management functions like prioritization, coordination, planning and review of research programs to ensure that the system functions with the requisite ac-countability in terms of efficiency and optimal utilization of resources. An administrative wing comprising Establishment, Audit and Accounts, Cash and Bills, and Stores effectively provides the required administrative support. The Estate section, besides maintenance of buildings, takes care of the vehicle management and security arrangements.

Farm

The main Institute in Coimbatore has a total area of 89.09 ha including farm, laboratory and office buildings. The farm area is 54.98 ha and is situated in four campuses *viz*., Main (7.28 ha), ECC (28.50 ha), Additional land (17.20 ha) and VPT (2.00 ha). ICAR-SBI Regional Centre, Karnal has 22 ha, ICAR-SBI Research Centre, Kannur has 8.33 ha and ICAR-SBI Research Centre, Agali has 12 ha.

Library & Documentation

The library provides information support to the Research and Development activities of the institute. It has a collection of around 14255 books including bound volumes of journals. The library continues to provide IP based online access to the e-journals and e-books through CeRA. Library has facilities *viz*., internet terminals, scanning and digital access to holdings through KOHA software for the users. It has got ISBN and ISSN assigning facility for the publications of the institute. Academic research support is provided to the students and scholars in the form of access to dissertations, thesis and reports of other ICAR institutes. The library also provides vital information on the sugar industry activities through sugar Industry publications. The priced publications of the institute (79 nos.) were sold for an amount of Rs.23385/- during the period.



Organizational Setup of ICAR-SBI

Weather Data

Weather data for January – December 2024

Month	Temperature (°C)		RH (%)		Wind velocity (km per hour)	Open pan evaporation (mm/day)	Rainfall (mm)	No. of rainy days
	Maximum	Minimum	Forenoon	After noon				
January	29.88	25.00	87.00	61.00	1.17	2.79	32.6	2.00
February	33.59	25.64	84.45	48.45	1.70	4.21	0.00	0.00
March	35.68	25.48	83.55	49.52	1.36	4.93	0.00	0.00
April	38.65	27.87	83.63	46.67	1.43	6.26	0.00	0.00
May	35.55	25.53	88.45	60.90	1.23	4.35	195.3	11.00
June	33.29	24.97	84.47	66.83	2.69	3.96	36	4.00
July	31.23	24.24	87.32	69.55	4.27	2.98	107.8	11.00
August	32.23	24.44	88.58	65.10	1.91	3.36	44.8	5.00
September	33.23	24.07	84.80	54.73	2.84	4.58	9.20	1.00
October	31.37	23.75	92.52	64.90	0.61	2.43	306.8	14.00
November	29.65	21.48	89.27	58.93	0.75	2.35	59.2	6.00
December	30.50	21.26	88.29	56.42	2.84	2.23	29.80	4.00
Mean/Total	**32.90**	**24.48**	**86.86**	**58.58**	**1.90**	**3.70**	**821.50**	**58.00**

04

Executive Summary

Institute has developed several impactful technologies and disseminated to the stakeholders including farmers, sugar mills and entrepreneurs during 2024. Co 17018, a mid-late maturing high-yielding sugarcane variety, was identified by the Varietal Identification Committee of AICRP (Sugarcane) for North Western Zone and notified by CVRC, during the year 2024. It was also one among the 109 climatic resilient varieties dedicated to the nation by the Honourable Prime Minister of India on 11.08.2024. A multiple stress tolerant clone, Co 12014, combining resistance to red rot, smut and YLD was approved by Plant Germplasm Registration Committee (INGR 24051) as genetic stock. It also served as one of the parents for two Co canes and two genetic stocks for high cane yield (Co 20013) and high sucrose percent in juice (Co 23019) combining resistance to red rot and smut.

A total of 19 Co canes of Co 24 series were selected, of which 13 were identified at Coimbatore and six at Karnal centre, and 15 clones namely Co 24001, Co 24002, Co 24003, Co 24004, Co 24005, Co 24009, Co 24010, Co 24011, Co 24012, Co 24016, Co 24017, Co 24018 Co 24019, Co 24020, Co 24021 were promoted for further testing in AICRP (S). During 2024 crossing season, 223 biparental crosses, forty-four poly-crosses and 119 general collections (GCs) were made, utilizing Co canes, ISH, IGH, CYM and exotic clones in the Arrowing plot.

A large number of around 65,000 seedlings were planted in the ground nursery during 2024, for evaluation. The biparental crosses involving the clones viz., Co 11015, Co 94008, Co 12014, Co 12009, Co 13014, Co 16018, Co 19009, CoVC 14061 and Co 86011 as one of the parents generated large number of progenies. In the first clonal trial, three hundred and twenty clones had HR brix of more than 20.0% at 240 days indicating their potential for early high sucrose accumulation. Progenies derived from the biparental crosses involving Co 11015 as one of the parents recorded high H.R. brix values at 240 days. From second clonal trials, 273 clones combining high yield, quality, red rot resistance and field stand were selected and promoted to PZVT multiplication 2024. In PZVT 2024, the clones Co 24003 (22.43%), Co 24007 (22.18%), Co 24013 (22.63%) recorded more than 22.00% juice sucrose at 12 months. The 'Co' cane Co 24009 had exhibited R/MR to red rot and smut, besides recording high sucrose % at harvest.

In ART 2023-24, pooled analysis of two plant and one ratoon crops indicated Co 15020 as the best genotype with 14.50 % and 19.06 % improvement over the commercial variety Co 86032 (140.28 t/ha and 17.00 t/ha) for cane yield and sugar yield respectively. The energy cane variety, SBIEC 14006, was licenced

to Hriday Hydrogen Power Private Limited, Pune during November 2024.

Altogether, 2277 sugarcane germplasm accessions were maintained in the newly developed "ICAR-SBI Wild Sugarcane Germplasm Repository" at Coimbatore, which included *Saccharum spontaneum* (1756), *Erianthus arundinaceus* (233), *Erianthus spp.* (178), allied genera (62) and improved *Erianthus* for fibre (48). Forty-seven accessions collected from Arunachal Pradesh were maintained at ICAR-IARI Regional Station, Wellington. Similarly, 1924 clones including 'Co' canes (1280), Co allied (16), foreign hybrids (52), ISH (283), IGH (37), PL (58), CD (84), CYM (94), IA (13), GU (1) and IND (6) were maintained at National Active Germplasm bank. A total of 291 notified varieties and registered genetic stocks were maintained and 26 clones were assigned index number. In addition, 1394 germplasm accessions including 'Co' canes, Co-allied clones, exotic hybrids, inter-specific and inter-generic hybrids, active collection of *Saccharum officinarum*, *S. barberi*, *S. sinense*, *S. robustum*, *Erianthus spp*, *Sclerostachya and Narenga* were maintained in Agali centre.

Two genetic stocks *viz*., GU 12-19 (INGR 24050) and GU 12-21 (INGR 24049) involving *Erianthus procerus* were registered with ICAR-NBPGR, New Delhi, wherein GU 12-19 was approved for excellent winter sprouting potential and red rot resistance and GU 12-21 was approved for broad spectrum resistance to red rot disease and winter sprouting potential. In 2024, *S. spontaneum* accessions *viz*., IND 04-1372, IND 99-847, IND 03-1307 and IND 03-1229 were identified as promising drought tolerant genotypes, whereas IND 99-889, IND 99-890, SES17, SES 79 and SES 206 belonging to *E. arundinaceus* exhibited high levels of tolerance against salt stress. Cytological studies in *S. spontaneum* and floral biological and cytological characterization of *Erianthus* is in progress. Culm anatomy studied in *Saccharum* species indicated intact peripheral vascular bundles in *S. robustum* and *S. spontaneum*, while in other species they were distantly arranged. These two species had high number of medium and large bundles. *S. sinense* possessed very small peripheral vascular bundles while *S. barberi* had lower number of small bundles. Meristem derived axillary buds were found to be the most suitable for cryopreservation. Although *S. spontaneum* clones were viable under long term storage , they exhibited very slow regeneration ability.

Fluff weighing 25.61 kg produced from crosses made at National Hybridization Garden, Coimbatore during 2023 flowering season was supplied to the 23 fluff receiving centres. ICAR-SBI facilitated the participating centres to effect 441 biparental crosses in 2024. At National Distant Hybridisation Facility, ICAR- SBI, Agali, a total of 105 crosses were made for the 21 participating centres. In addition, off season nursery of 750 plants from ICAR-NRCB is being maintained at the centre. Under DUS testing, five and four varieties were tested in tropical (Coimbatore and Agali) and subtropical centre (Karnal), which were found to be distinct from reference varieties.

Under AICRP (S), the entries Co 17001 and Co 17004 performed better at Coimbatore based on two plant and one ratoon crops in AVT. In IVT, Co 20005 and Co 20009 were the best among twenty-three entries for cane yield and sucrose % respectively. At Karnal, Co 19017 and Co 18022 were the best midlate entries for cane yield and sucrose% in AVT I and AVT II respectively, while Co 20016 (early) and Co 20017 (midlate) were the best in IVT.

Under Sweet Bloom 2.0 , two clones viz., Co 19009 and Co 20011 performed better than Co 86032 for yield and quality at harvest. Similarly, to identify location specific sugarcane varieties for commercial cultivation under different agro-climatic situations in India, an MoU was signed between ICAR- SBI and ISMA (Indian Sugar Mills Association) , wherein different sets of elite clones were supplied to participating sugar mills in tropical and subtropical regions. Preliminary evaluation indicated that two clones viz., Co 20016 and Co 21012 were the best among nine entries across the factories in subtropical region.

Under farmer participatory seed production programme in 2023-24, progressive seed farmers have been selected to undertake seed production from Seyur and Neelambur villages in 28.60 acres. About 911.15 tons of quality seed has been supplied during February–April, 2024 to cooperative and private sugar factories. To meet the quality seed cane material requirement, planting was taken up in 35.98 acres in Coimbatore and Tiruppur districts during July - September, 2024. At Karnal, a total of 25453.5 quintals of breeder seed was produced and supplied to various stakeholders in the sub-tropical region.

Significant progress was made from studies pertaining to sugarcane genomics and molecular markers. Dehydrin gene was cloned in the drought tolerant clone AS 04-1687, from transcriptome data, whose sequence characterization confirmed the presence of an ORF that

codes for 141 amino acids. Genomic DNA was isolated from AS-04-1687 for the amplification of Homeo domain leucine Zipper (HDLZ) transcription factor. Amplification product of ~3.0 kb was cloned using blunt end cloning strategy into pJET vector. RNA was isolated from drought imposed AS-04-1687, converted into cDNA, and used as template for the amplification of the coding sequence of HDLZ. Amplified product of size 1.3 kb was then cloned and submitted for sequencing. Analysis of spots obtained through 2D-proteomic analysis and further MALDI-TOF identified extracellular xylanases of 26.3 and 27 kDa (xyl I); 7.7 and 17.7 kDa (xyl II), hemicellulases, and pectinases. Five primers were designed to amplify the GRAS 28 transcription factor gene from the genomic DNA of abiotic stress tolerant and susceptible clones, where amplified DNA band showed high similarity to GRAS transcription factor of R570 genome. To harness comparative genomics and bioinformatics tools for abiotic stress tolerance in sugarcane, alignment search was performed using the protein sequence of drought and salinity tolerance related genes from crops such as rice, sorghum, maize and Arabidopsis alongside the protein sequence of sugarcane, and the results indicated the highest similarity observed with sorghum genes. EaPHT promoter isolated from *Erianthus (Tripidium) arundinaceus*, capable of directing high level constitutive expression of a target nucleotide sequence of interest in a plant has been certified as technology by ICAR (ICAR-CS-SBI-Technology-2024-009). Quantitative proteomics analysis of the tiller node tissues from a high (Co 86032) and low tillering genotype (Co 99004) identified 2,867 significantly differentially abundant proteins. Sugarcane invertase inhibitors (ShINH1 and ShINH2) over-expressed transgenic lines were successfully developed. The event ShINH2-VT-5 showed the highest sucrose content of 20.37 % against untransformed controls Co 62175 (16.42 %) and Co 86032 (19.93 %).

In Karnal, first-year DUS (Distinctness, Uniformity, and Stability) testing for three candidate varieties —CoLk 15201, CoLk 15207, and CoLk 15466 was conducted along with the second-year DUS test for Co 16030, and all the four candidates were found to be different from reference varieties. In pot culture, seven genotypes (Co 20016, Co 17018, Co 18022, Co 98014, Co 22020, Co 21014 and Co 22021) recorded high cumulative root length, surface area and root volume under moisture stress.

Flowering in germplasm accessions at Kannur ranged from 4.88% (*S. officinarum*) to 95.38 % (IA hybrids). Red fleshed *S. robustum* accession NG 77- 132 was consequently found to be free from INB incidence for five years at the field level and identified as INB-resistant source for the pre-breeding programme.

Studies on mechanization revealed that application of Bt—62 culture through Bio Formulation Applicator (previously known as EPN applicator) in sugarcane crop resulted in decreasing white grub population. Planting of sugarcane settling with mini tractor-operated sugarcane planter recorded on par cane yield (126.10 t ha^{-1}) with IISR two row deep furrow sugarcane planter (130.20 t ha^{-1}) and manual two budded sett planting (116.50 t ha^{-1}). Mini tractor-operated sugarcane planter was found useful in saving time and labour.

Sugarcane genotypes, Co 17004 (180.10 t/ha) and CoVC 17061 (170.2 t/ha) followed by Co 17001 (163.22 t/ha) have recorded significantly higher cane yields than the standard check varieties Co 86032 (156.85 t/ha), Co 09004 (155.90 t/ha) and CoC 671 (138.88 t/ha) across two plant and one ratoon trials. Sugarcane clones Co 18002, Co 18003, Co 18009, and Co 19008 showed better morpho-physiological traits under saline conditions. Soaking Sugarcane setts in 0.8% Potassium Salt of Active Phosphorus (PSAP) solution + application of 100 % N and 50% of P &K of RDF + foliar spray of PSAP @ 0.4%, 0.65%, 1.0% and 1.10 during 60, 80, 100 and 120 DAP produced higher cane yield. The weed control efficiency was higher in the pre-emergence application of Clomazone 30% + Sulfentrazone 28% WP (ready mix) 2.5 kg/ha followed by one inter-cultivation at 60 days after planting (partial earthing up-72.36%). Cane yield was significantly higher in drip irrigation (165.28 t/ha) followed by trash mulching (134.29 t/ha) and skip furrow irrigation (130.79 t/ha). However, trash mulching and skip furrow were on par with farmers' practice of irrigation scheduling (131.89 t/ha).

Two species of white grub, sugarcane internode borer and red weevil palm were prospected for gut microflora to use them as potential sources for cellulose-based biomass degradation, especially sugarcane bagasse for 2G ethanol production. Successfully identified 28 morphologically distinct bacterial isolates. Out of these, sixteen of them showed significant cellulolytic activity. The maximal cellulolytic index values for isolates S4, C9 and I2 were 3.67, 3.25 and 1.00 respectively. C1 isolate exhibited a 71.2% bagasse degradation capacity.

Study on the effect of various tillage and weed management involving various new generation herbicides molecules, trash mulch intercrops revealed

that total weed count at 180 DAP was higher in conventional tillage (18.3 no. m^{-2}) than in reduced tillage (13.1/ m^2). In another experiment, among different weed management treatments, pre-emergence pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} + brown manuring with daincha *fb* trash mulching @ 10 t ha^{-1} *fb* application of metribuzin +2,4-D + pyrazosulfuron ethyl (ready mix) @ 3 kg ha^{-1} after final earthing up recorded the lowest weed count of 9.2 no. m^{-2}. Reduced tillage (18.1%) and mulching treatment (15.9%) retained more soil moisture as compared to conventional tillage (14.5%) and without mulching treatment (13%).

The physiological efficiency of ten sugarcane hybrids was evaluated for their water and radiation use efficiency under full and deficit irrigation conditions. The clones Co 85019, Co 14002, Co 15021, and Co 14025 recorded higher radiation use efficiency (Eu effy >2.0) and water use efficiency under water deficit conditions. Studies on plant architectural traits for developing ideotype concept in sugarcane for tropical conditions revealed that clones with both erect leaves at the top and the planophile leaves at the bottom layer have an advantage in harvesting solar radiation for effective use of photosynthesis. The mid-point vertical height of the TVD leaf had a positive correlation with cane yield in Co canes. Canopy cover (%) at the early stage of the crop favoured effective harvesting of solar radiation, translation in the form of biomass production, and subsequent partitioning towards sink development besides inhibiting the weed growth by shadowing.

Hydroponic screening methodologies for sugarcane varietal evaluation in response to abiotic stress under controlled conditions was developed. Foliar spray formulations to alleviate the effect of moisture deficit in sugarcane showed a positive response in maintaining better membrane stability, photosynthetic pigments, compatible osmolytes, phenolic content, starch, soluble protein content, and antioxidant enzymes in leaves during the formative phase, which leads to maintaining better leaf and stalk biomass during the grand growth and harvest stages. The efficacy of these formulations showed a significant increase in the number of millable canes, and cane weight under unirrigated conditions at harvest.

Sugarcane Settling Transplanting Technology (STT) which included transplanting settlings (25-30 days old), wider row spacing(1.5 m x 0.6 m), intercropping, subsurface drip irrigation, fertigation based on soil test crop response and mechanization was demonstrated in Vertisol. This technology resulted in increase in cane yield compared to conventional method of cultivation. Characterization of canopy and biomass estimation in sugarcane using drone-based optical images showed that canopy cover derived from digital image analysis had very high positive correlations of r 0.82*** with biomass and NDI values among colour indices.

Soil profile studies in waterlogged and well-drained soil in a topographic sequence revealed that water-logged soil had higher bulk density (1.68) and less hydraulic conductivity (1.87 cm/hr) at the surface compared to the well-drained soil (1.28 and 11.7 respectively for bulk density and hydraulic conductivity). In calcareous soil, application of 50% phosphorus as DAP at Basal and 50% phosphorous as DAP at 90 Days after Transplanting (DATP) and application of 50% phosphorus as SSP as Basal + 50% phosphorus as DAP at 90 DATP produced more tillers than application of entire phosphorus as basal.

A combination of microwave heating with chemical preservation of sugarcane juice had satisfactory storage stability of more than 21 days at refrigeration. Standardized the process for the preparation of different types of *burfis* with sugarcane juice. Preliminarily, freeze-dried stem extract was analyzed for in vitro □-amylase inhibitor and □-glucosidase activities and found significant bioactivity of stem extract indicating the therapeutic role. Among sugarcane-based value-added products, sorghum-based halwa was found to be best and the squash prepared using passion fruit and liquid jaggery was the tastiest based on sensory evaluation, in Kannur.

Under CCT method, among the screened clones, 580 clones (18.26%) were free from red rot infection and rated as resistant (R) and 655 clones (20.62%) were categorized as moderately resistant (MR) and the remaining clones were rated as susceptible (S) or moderately susceptible (MS) or highly susceptible (HS). Under Quarantine, 32 genotypes were received for inclusion in National Active germplasm (NAG) bank and out of these only two genotypes (CoH 20261 from Uchani and GUK 14-48 from Kannur) could not establish at Coimbatore. The remaining 30 genotypes were permitted for inclusion in NAG bank at ICAR- SBI, Coimbatore. IVT and AVT clones were evaluated for red rot, smut and other major insect pests in sugarcane and resistant and tolerant clones were identified. Altogether, 76 TC plants were received from TC lab, ICAR-SBI for indexing of non-fungal diseases from the check varieties such as Co 86032, Co 11015, Co 18009, and Co 14012.

Of these, 82% and 15% of TC materials were free from SCYLV and SCGS phytoplasma, respectively. The stability and dynamics of Cf EPL1- PR1 complex was validated by molecular dynamics simulations, as a prelude to identify interacting partners during Sugarcane and *Colletotrichum falcatum* interaction. In mechanised priming of sugarcane and other vegetatively propagated crops such as Gladiolus, Chrysanthemum, tuberose, Crossandra and Banana in Sett Treatment Device (STD), using chemicals, biocontrol agents and fertilizers alone or in combination effectively controlled the wilt incidence, also improved the germination and growth of plants. Hot water treatment at 54^{0}C using STD, also significantly reduced the lesion nematode population in the infected turmeric rhizomes. In a study involving phytoplasma and host interaction, the presence of phytoplasma was established systemically in all the parts of sugarcane. Whole genome mining of SCGS phytoplasma revealed 404 protein-coding genes, of which about 7.5-8.2% were identified as virulent proteins/ effectors. Various endophytic bacteria and rhizosphere colonising microbes were studied for growth promotion and antagonistic properties. Many were positive for ammonia production, phosphorous (P) solubilization, Zinc (Zn) solubilization, siderophore production and IAA production and many bacteria strongly inhibited the growth of *Colletotrichum falcatum* and *Fusarium sacchari in vitro* respectively. Thirteen designated *C. falcatum* pathotypes (CF01 to CF13) were characterized and two morphotypes were identified. In the preliminary study of Multi Locus Sequence Typing (MLST) of *C. falcatum* using six genes indicated minor variation of sequences in few of the genes. The red rot isolates *Cf11015* (Thiruvendhipuram) and *Cf11015* (Periyasevalai) were comparatively more virulent than other tested isolates. The clones such as Baragua, CoS 8436, CoSe 95422, CoV 92102 and SES 594 remained resistant to most of the tested isolates. BO 91 and Khakai were showing intermediate reactions (MS) against many isolates.

Whole genome sequencing of Bt isolates from Uttar Pradesh, Tripura and Western ghats of Karnataka revealed the presence of novel cry toxin genes such as Cry 8, Cry54 gene family, Cry70Aa and Cry70Ba crystal toxin gene. The *CHSA* gene, which is inevitable for the synthesis of chitin during moulting process has been identified as the appropriate candidate for RNAi both in ESB and INB. Different mass multiplication methods were standardized for *Telenomus dignus* and *Cotesia flavipes* parasitoid of internode borer. Field trials conducted with the parasitoid at different dosages and frequency showed evidence of higher parasitoid recovery in the release plots for *Cotesia flavipes* and *Telenomus* released at a dosage equivalent of 1000 parasitoids/ha in the field reduced post-release INB level as opposed to an increase in INB level in control plot. In early detection mechanism of resistance operating in sugarcane intergeneric hybrids study, tolerant(T) and moderately tolerant (MT) genotypes were identified. Nine tolerant genotypes, *viz*., GU 19-4, GU 19-7, GU 19-27, GU 19-28, GU 19-60, GU 19-61, GU 19-72, GU 19-78 and GU 19-85 recorded <5% ESB incidence. Despite INB infestation, no significant reduction in internode length or girth was found in the IGH clones, *viz*., GU 19-4, GU 19-10, GU 19-24, GU 19-22, GU 19-38, GU 19-39, GU 19-43, GU 19-55, GU 19-77, and GU 19-85 and also in SBIEC 13010 and SBIEC 14006 energy canes. A total of 291 clones maintained at DUS and NAG collections were screened for their reaction to *P. saccharifolii*. Of these, 27 clones were free from the mealybug incidence in both the cropping seasons. The Type II energy cane SBIEC 11004 was one among the clones that was observed to be free from the incidence of the mealybug. Among the granular insecticides evaluated, cartap hydrochloride 4% GR, thiamethoxam 1% + chlorantraniliprole 0.5% and carbofuran 3% CG were observed to be superior with more than 85% reduction over control after two applications. Profiling of silicon at the preferential feeding sites of sugarcane borers revealed that the silicon content was highest in all parts of the Type II energy cane SBIEC 14006, followed by SBIEC 11004 and SBIEC 11001 and among the varieties studied, the silicon content in the leaf sheath and rind was the highest in the variety Co 06030 followed by Co 06022 and Co 0238.

Successful mass production of four *Steinernema* spp. (*Steinernema surkhetense* SBIP3, *S. thermophilum* SBIH1, *S. siamkayai* SBITNT1, *Steinernema* spp. SBIUP96) using liquid media was achieved. Two EPN isolates (*S. surkhetense* SBIP3 and *S. siamkayai* SBITNT1) cultured *in vivo* and *in vitro* were tested against *Galleria mellonella* larvae with different dosages and mortality which ranged between 60 to 100%. Seventy-eight EPN strains [Tropical (49) and subtropical (29)] were maintained in the culture collection and 45 symbiotic bacteria belonging to *Photorhabdus* spp. (26 Nos.) and *Xenorhabdus* spp. (19 Nos.) were also maintained in glycerine.

The Institute had organized the 22nd Sugarcane Research & Development Workshop of Southern Karnataka in Mysuru , during 20-21 June 2024, which was jointly hosted by Coromandel Sugars Ltd., Makavalli and M. Visvesvaraya Sugarcane Research Centre,

Mandya of S.Nijalingappa Sugar Institute, Belagavi. The event was attended by over 250 delegates . Topics such as 'Managing drought & measures to improve irrigation water use efficiency' and 'Interventions for improving sugarcane yields in Southern Karnataka' were discussed.

The ISSCT (International Society of Sugar Cane Technologists) 13th Breeding and Germplasm and 10th Molecular Biology Workshop and Winter School on "Climate Smart Sugarcane Agriculture for Food and Energy Security in India" were organized by the Institute for dissemination of research findings.

SugarcaneEdge, the sugarcane-based Agri-Business Incubator at the Institute has installed several instruments, including a vacuum oven, tray dryer, HPLC column, wine refractometer, and other small equipment for pilot-scale production and development of novel food products. Data on variety Co 11015 to study the technical feasibility and economic viability of cultivating three crops in two years and the impact of Soil Moisture Indicator (SMI) on water conservation, were collected. SMI users had reported that that they could save irrigations due to usage of SMI, per crop cycle. In an effort to develop an expert software system for analysing crop science data, inputs were collected from the institute's scientific staff, particularly from the breeding unit, regarding their requirements for statistical tools.

In the recent months, reports of incidence of Crown Mealy Bug (CMB) and Pokkah Boeng (PB) in sugarcane in certain districts of Tamil Nadu have been on the rise. In view of this, the Institute organized a 'Workshop on Management of Crown Mealy Bug and Pokkah boeng in Sugarcane' in association with Society for Sugarcane Research & Development (SSRD), during November 2024 for the benefit of sugarcane development personnel belonging to the districts of Villupuram, Cuddalore, Kallakurichi, Ariyalur, Perambalur, Namakkal, Thanjavur, Tiruchirappalli, Tiruvannamalai, Dharmapuri and Erode.

Two Frontline Demonstrations on the newly released cane varieties viz., Co 11015 and Co 14012 were conducted in Tiruvannamalai (North eastern agroclimatic zone) and Erode (Western agroclimatic zone) districts of Tamil Nadu. Field days were conducted in both the fields, in which a large number of sugarcane farmers and cane development personnel participated.

The Institute had organized 21 one-day training programmes with 733 trainees, conducted 123 exposure visits benefitting 8932 students/academicians and had arranged for 53 personalized advisories benefitting 134 sugarcane farmers, in Coimbatore. A Brain Storming session cum training on "Sustainable sugarcane farming in subtropical India" and off-campus / on-campus one-day trainings organized at Karnal.

The Institute launched a 'Farm School on *All India Radio*' on '*Sugarcane farming for prosperity*' (வளமான வாழ்விற்கு கரும்பு சாகுபடி), with 13 classes, for the benefit of the sugarcane farmers to gain the latest technical knowledge and information on scientific sugarcane. The Institute also organized three sponsored -training programmes on improving sugarcane productivity for the farmers of Maharashtra and Andhra Pradesh.

The Institute actively participated in the nationwide campaign "*Viksit Bharat Sankalp Yatra*". Altogether, 46 Institute staff covered 1031-gram panchayats to raise awareness on various government schemes among the farmers belonging to five districts of Tamil Nadu viz., Sivagangai, Villupuram, Tiruppur, Virudhunagar and Tiruvannamalai.

Upon a request from the Tamil Nadu State Rural Livelihood Mission, Salem the DAPSTC (Development Action Plan for Scheduled Tribe Component) was implemented in in five villages of Eastern Ghats (Chinna Kalrayan hills) in Salem district of Tamil Nadu. Of these, training campaigns on scientific sugarcane cultivation were conducted for the tribals of two tribal settlements viz., Molayanoor and Vilampattu. The impact of this project was widely covered in print and electronic media.

ITMU coordinated the overall institute's intellectual property, and commercialization activities. Received registration certificates for five varieties from PPV&FRA. Two patents and one design patent were granted. Four NBA Form 2 applications were submitted pertaining to the export of varieties and energycane to foreign countries. Licensed Soil Moisture Indicator technology, energy cane (SBIEC14006) and ICAR-SBI EPN biopesticide formulation, Production of cane jam from sugarcane.

Two students of the Institute were awarded PhD degrees by Bharathiar University, Coimbatore. Altogether, 214 students had undergone internship while 19 had completed their mandatory project work towards post-graduation at the Institute. Altogether, six externally-funded projects were sanctioned for the Institute by DBT, DST-SERB and other government sources with an outlay of Rs. 338.436 lakhs. Ten Institute scientists were deputed abroad for participation in trainings/conferences

as well as to serve as experts under ITEC programme of Ministry of External Affairs, India.

New facilities such as *ex-situ* facility for conservation of wild sugarcane germplasm Sir. T.S. Venkataraman *Sumadhuram* Hall, a state-of-the-art auditorium in Coimbatore and Microplots with rainout shelters at Karnal were created.

Institute scientists were honoured with awards and recognitions such as Fellowship from the National Academy of Agricultural Sciences (NAAS), New Delhi, Tamil Nadu Scientist Award (TANSA) from the Tamil Nadu State Council for Science and Technology, Govt. of Tamil Nadu, R. H. Dastur Gold Medal Award 2024 from the Indian Society for Plant Physiology, Pushpavathi Blessing Garapati Gold Medal from the South Indian Sugarcane & Sugar Technologists' Association (SISSTA), SSRP (Society for Sugar Research and Promotion) Fellowship-2024 and Sir T S Venkataraman Biennial Award for 'Outstanding Research in Sugarcane', for their contribution in their respective spheres of research.

05

Research Achievements

5.1. Crop Improvement

5.1.1 Breeding

Breeding superior sugarcane varieties of different maturity with improved cane yield, quality and resistance to biotic and abiotic stresses

Breeding sugarcane varieties for tropical region

Germplasm registered: Co 12014 (2010-171) - A multiple stress tolerant clone combining resistance to red rot, Smut and YLD was approved in the XXXXXII meeting of Plant Germplasm Registration Committee held on 22nd May, 2024. This clone is derived from a biparental cross between Co 97007 and Co 775 through hybridization and selection. Co 12014 is a high yielding genotype with high number of millable stalks and sucrose content. Two Co canes (Co 21005, Co 22003) and two genetic stocks for high cane yield (Co 20013) and high sucrose percent in juice (Co 23019) combining resistance to red rot and smut were developed from the biparental crosses involving Co 12014 as one of the parents.

Co 12014 registered with ICAR-NBPGR as a source for multiple stress tolerance

'Co' canes identified (2024)

Thirteen elite clones were identified from the pre-zonal varietal trial conducted during 2023-24 and assigned Co number (Co 24001 to Co 24013) based on cane yield, CCS yield, sucrose%, reaction to red rot and smut diseases. Two clones *viz.*, Co 24014 and Co 24015 were identified as genetic stocks. The performance of these elite clones in comparison with the standards is presented in table.

Performance of 'Co' canes identified at Coimbatore

Co number	Parentage	CCS yield (t/ha)	Cane yield (t/ha)	Sucrose %		Red rot	
				300 days	360 days	Plug	Nodal
Co 24001	Co 98010 x Co 97015	18.46	131.93	17.39	20.12*	MS	R
Co 24002	Co 99006 x Co 0209	18.97	134.66	17.38	20.10*	MS	R
Co 24003	Co 11015 x Co 12009	23.80*	150.00*	20.58	22.48*	R	R
Co 24004	Co 11015 x Co 16017	21.10*	141.66*	19.06	21.27*	MR	R
Co 24005	Co 99006 x CoT 8201	20.22*	141.15	18.04	20.64*	MS	R
Co 24006	Co 8371 x Co 94008	18.61	137.73	17.19	19.36	MR	R
Co 24007	Co 11015 x Co 13014	18.20	116.52	18.42	22.18*	MR	R
Co 24008	Co 14020 x Co 11015	20.11*	144.04*	16.65	19.85	MS	-
Co 24009	Co 11015 x Co 16017	19.22	134.34	17.73	20.33*	MR	R
Co 24010	Co 0238 GC	17.72	122.61	20.24	20.74*	MS	R
Co 24011	Co 10026 x Co 11015	18.66	133.00	18.10	20.23*	MR	R
Co 24012	Co 86032 x PC (Co 11015, Co 12009, Co 16006)	22.20*	164.77*	16.94	19.46	MS	R
Co 24013	PZVT2017-187 GC	23.77*	149.06*	19.47	22.63*	-	-
Genetic Stocks							
Co 24014	Co 05008 x CoT 8201	23.73	158.13	18.76	21.55	HS	S
Co 24015	GUK15-474 x WL12-101	15.12	110.53	16.52	19.88	MR	R
Standards							
Co 86032		15.02	118.50	16.63	18.27		
Co 09004		18.78	124.08	19.57	21.60		
Co 11015		19.19	130.66	19.80	20.86		
CoC 671		15.91	107.99	18.00	21.13		
CD		4.48	22.97	1.83	1.72		
CV		13.22	13.51	5.40	4.46		

'Co' canes selected for AICRP(S) trials:

Out of fifteen 'Co' canes identified in the pre-zonal varietal trial conducted at Coimbatore, nine 'Co' canes *viz*., Co 24001, Co 24002, Co 24003, Co 24004, Co 24005, Co 24009, Co 24010, Co 24011 and Co 24012 were selected for ZVT testing under AICRP in peninsular zone.

Hybridization (2024)

In 2024, flower initiation was observed during the last week of October and extended up to the first week of December 2024 in the arrowing plot. Flowering intensity of 58.6% was observed during the season. A total of 223 biparental crosses and forty-four polycrosses were made, which included 209 crosses between tropical and tropical clones, fifty-three crosses involving tropical and sub-tropical clones and 5 crosses involving exotic, ISH, IGH, CYM clones. Male parents frequently used in hybridization include Co 0209, Co 12009, CoT 8201, Co 12009, Co 19014, Co 19006 and Co 16018. Recently identified 'Co' canes such as Co 24002, Co 24004, Co 22018, Co 24008, Co 20013 and Co 22012 were utilized in the crossing programme. A total of 119 general collections (GCs) was also made.

(R.M. Shanthi, S. Karthigeyan, K. Mohanraj, S. Sheelamary, T. Lakshmi Pathy, R.T. Maruthi, R. Gobu and K. Praveen)

Ground nursery (2024)

24,090 seedlings were raised from 134 biparental crosses, twenty polycrosses and fifteen general collections and planted in the ground nursery during January, 2024. The crosses Co 13014 x Co 21005, Co 11015 x CoM 20082, Co 86011 x CoVC 14061, Co 13014 x Co 94008, Co 16018 x Co 11015, Co 11015 x Co 8347, Co 10033 x Co 12009, Co 11015 x Co 97015, Co 11015 x Co 12014, Co 13014 x Co 11015, Co 21011 x Co 16018, Co 8371 x Co 19009, Co 21009 x Co 19009, CoVSI 17121 x Co 12009, Co 10033 x CoSe 92423 recorded satisfactory seed set with high seedling population and good establishment in ground nursery. The biparental crosses involving the clones Co 11015, Co 12009, Co 13014, Co 16018, Co 19009, Co 10033 and Co 86011 as one of the parents gave large number of seedling progenies.

(G. Hemaprabha, R.M. Shanthi, S. Karthigeyan, K. Mohanraj, V. Sreenivasa, S. Sheelamary, V. Vinu and R.T. Maruthi)

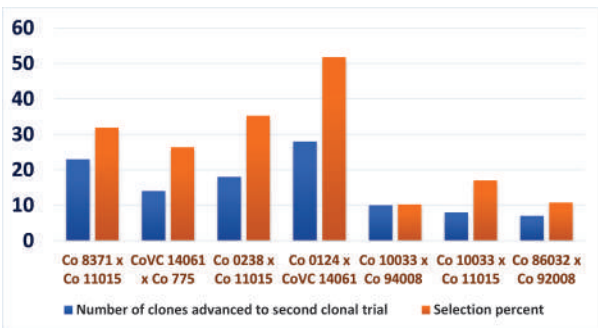
Seedling raising for ground nursery (2024)

A total of 41,000 seedlings raised from 150 biparental crosses, fifteen polycrosses and thirty general collections were planted in ground nursery during December, 2024. The crosses Co 19005 x Co 775, CoV 89101 x Co 12014, Co 22014 x Co 12014, Co 13015 x CoTl 14111 gave higher number of seedlings. The biparental crosses involving the parental clones *viz*., Co 94008, Co 10033, Co 12014, Co 0209, Co 11015, Co 12009, Co 13014, Co 16018, Co 18008, Co 20013, CoVC 14061, Co 19009, Co 19014 exhibited good seed set and establishment in ground nursery.

(S. Alarmelu, A.J. Prabakaran, A. Anna Durai, R. Karuppaiyan, C. Appunu, Adhini S. Pazhany, K. Elayaraja, H.K. Mahadeva Swamy and K. Gopalareddy)

First Clonal trial (2023-2024)

Six hundred clones from the ratooned ground nursery were evaluated for NMC, cane thickness, cane height and HR Brix at 300 days. One hundred and six clones had HR brix of >20.0 % at 240 days. The biparental crosses *viz*., CoPant 97222 x Co 11015, Co 11015 x Co 94008, Co 10033 x Co 11015, Co 11015 x CoVC 14061, CoC 671 x Co 97015, Co 19014 x Co 11015 and polycross of CoC 671 were the best with a mean HR brix % of 20.61 %, 23.15 %, 22.48 %, 20.14 %, 21.22 %, 20.98 % and 22.18 % respectively at 240 days. Crosses with Co 11015, CoC 671, Co 17003, Co 0118 and Co 12009 as one of the parents recorded higher early sucrose accumulation. 106 clones recorded more than 20.0% brix at 240 days in this trial.



Promising cross combinations with high selection percent in first clonal trial

(S. Alarmelu, A.J. Prabakaran, A. Anna Durai, R. Karuppaiyan, C. Appunu, K. Elayaraja, Adhini. S. Pazhany and H.K. Mahadeva Swamy)

First Clonal trial (2023-2024)

Two thousand nine hundred and sixty clones were evaluated for NMC, cane thickness, cane height and HR Brix at 300 days. Two hundred and nineteen clones had HR brix of more than 20.0% at 240 days indicating their potential for early high sucrose accumulation. The crosses Co 11015 x Co 12009, Co 11015 x Co 94008, Co 8371 x Co 11015, Co 0327 x Co 11015, Co 11015 x CoVC 14061 were found to be promising for high H.R. brix (≥20.0 %). Progenies derived from the biparental crosses involving Co 11015 as one of the parents recorded high H.R. brix values at 240 days.

(G. Hemaprabha, R.M. Shanthi, S. Karthigeyan, K. Mohanraj, V. Sreenivasa, S. Sheelamary and V. Vinu)

Second clonal Trial – Trial I

Eight hundred and forty clones promising for yield, juice quality and red rot resistance were evaluated in second clonal trial along with four standards *viz*., Co 86032, Co 09004, CoC 671 and Co 11015 in an augmented RCB design. At 11th month, 56 clones recorded more than 21.0% sucrose in this trial. The clone 2022-24 developed from the cross Co 11015 x Co 97015 recorded a maximum sucrose of 21.95%. Three clones from this trial *viz*., 2022-14, 2022-130, 2022-174 recorded the single cane weight of more than 2.70 Kg. The clone 2022-136 identified from the cross Co 11015 x CoVC 14061 recorded a maximum cane height of 310 cm. Screening the clones for red rot by CCT method indicated 18.33% of the clones were exhibiting resistance to red rot and 84 clones combined both high juice quality and red rot resistance. From this trial, 105 clones combining high yield, quality, red rot resistance and field stand were selected and promoted to PZVT multiplication 2024.

Promising families for cane yield traits and sucrose percent in second clonal trial

Crosses with high selection percent	Co 0327 x Co 0209, Co 11015 x Co 12009, CoLk 8102 x Co 12014, Co 8371 x Co 12009, Co 11015 x Co 97015, Co 86032 X Co 11015, Co 11015 x 85 R186, Co 11015 x CoVC 14061
Outstanding entries for different characters	
No. entries > 21% sucrose at 330 days	56
Cane height > 300 cm	33
Single cane weight > 2.5 Kg	10
Cane diameter > 3.5 cm	9
Red rot resistant entries (R & MR)	27 (R), 127 (MR)

(G. Hemaprabha, R.M. Shanthi, S. Karthigeyan, K. Mohanraj, V. Sreenivasa, S. Sheelamary and V. Vinu)

Second clonal Trial - Trial II

A total of 1420 clones were evaluated for yield and quality traits along with four standards *viz*., Co 86032, Co 09004, CoC 671 and Co 11015 in an Augmented RCB design. Twenty-seven clones recorded more than 21.0% sucrose at 10th month compared to 18.36 % recorded in the best standard Co 86032 and three more clones recorded more than 22.0% sucrose at 12th month. Sixty-two clones combined high juice sucrose along with red rot resistance. Clones with Co 11015, Co 86032, PZVT 2018-47 and CoC 671 as one of the parents recorded higher early sucrose accumulation. These clones together contributed for more than 35% of selections. Red rot reaction of the entries through CCT indicated that 12.37 % clones were resistant/moderately resistant types. A total of 168 clones with good field stand, yield, quality and red rot resistance were promoted to PZVT 2024 for further evaluation.

Best biparental crosses for cane yield and juice quality in second clonal trial

Crosses with high selection percent	Co 86032 x CoV 92102, CoM 0265 x CoC 671, Co 86032 x 85 R 186, Co 11015 x CoV 92102, Co 11015 x Co Pant 97222, Co 10033 x Co Pant 97222, Co 11015 x Co 94008, Co 8371 x Co 11015, CoVC 14061 x Co 12009, Co 17003 x Co 18009, CoM 0265 x Co 97015, CoVC 14061 x Co 11015
Outstanding entries for different characters	
No. entries > 21% sucrose at 300 days	27
No. entries > 22% sucrose at 360 days	3
Cane height > 300 cm	14
Single cane weight > 2.5 Kg	3
Cane diameter > 3.5 cm	4
Red rot resistant entries (R & MR)	188
Clones combining high sucrose (>20 %) and red rot resistance	62
Clones promoted to PZVT 2024	168

(S. Alarmelu, A.J. Prabakaran, A. Anna Durai, R. Karuppaiyan, C. Appunu, K. Elayaraja, Adhini S. Pazhany, H.K. Mahadeva Swamy and K. Gopalareddy)

Pre-Zonal Varietal Trial (Location: Coimbatore)

Performance of 'Co' canes identified during 2023-24 at Coimbatore

Eighty-six clones were evaluated in a randomized block design with two replications along with four standards *viz.*, Co 86032, Co 09004, Co 11015 and CoC 671. A total of thirteen elite clones were selected and assigned 'Co' number (Co 24001 to Co 24013). Two clones *viz.*, Co 24014 and Co 24015 were identified as genetic stocks. Among the 'Co' canes, Co 24003 recorded significantly higher CCS yield (23.80 t/ha) followed by Co 24013 (23.77 t/ha), Co 24012 (22.20 t/ha), Co 24004 (21.10 t/ha), Co 24005 (20.22 t/ha) and Co 24008 (20.11 t/ha) as against 15.02 t/ha CCS yield of the standard Co 86032. Six 'Co' canes *viz.*, Co 24012 (164.77 t/ha), Co 24003 (150.00 t/ha), Co 24013 (149.06 t/ha), Co 24008 (144.04 t/ha), Co 24004 (141.66 t/ha) and the genetic stock Co 24014 (158.13 t/ha) recorded significantly higher cane yield than the standard Co 86032 (118.50 t/ha). Ten 'Co' canes recorded significantly higher sucrose % than the standard Co 86032 (18.27%) at harvest. Of these ten 'Co' canes, Co 24003 (22.43%), Co 24007 (22.18%), Co 24013 (22.63%) recorded more than 22.00% juice sucrose at 12 months. The 'Co' cane Co 24009 had exhibited R/MR to red rot and smut, besides recording high sucrose % at harvest.

(R. Karuppaiyan and S. Sheelamary)

Pre-Zonal Varietal Trial (Multiplication)

Three hundred and three clones along with four standards (Co 86032, CoC 671, Co 11015 and Co 09004) were multiplied for conducting PZVT in the subsequent year. Among the clones 2023-133 recorded a maximum of 22.22 % sucrose followed by PZVT 2023-146 (21.84 %) and PZVT 2023-58 (21.66 %) in comparison with the standards Co 86032 (18.95 %), CoC 671 (21.65 %), Co 09004 (21.19 %) and Co 11015 (21.18 %) at 330 days. Ten clones *viz.*, PZVT 2023-14, PZVT 2023-58, PZVT 2023-70, PZVT 2023-82, PZVT 2023-133, PZVT 2023-146, PZVT 2023-149, PZVT 2023-203, PZVT 2023-294, PZVT 2023-298 recorded sucrose percent of >21% at 330 days. About 123 clones showed resistance to red rot (CCT). Based on cane yield, quality, field stand, flowering, absence of spines and red rot reaction, 73 clones were selected for further evaluation under PZVT.

(K. Elayaraja and R.T. Maruthi)

Arrowing plot

Three hundred and sixty-one clones including recently developed 'Co' canes, parents of proven crosses, genetic stocks, cytoplasmically diverse (CYM, CD) clones and energy canes were planted for making crosses during the year 2024.

(S. Karthigeyan and R.T. Maruthi)

Screening for diseases

***Screening for Red rot*:** Seventy-four PZVT clones along with five standards were screened for red rot resistance under field condition by both plug and nodal methods with CF06 pathotype. In plug method, among the screened clones, 21 were identified as resistant (R), 36 were moderately resistant (MR), 10 were moderately susceptible (MS), 5 were susceptible (S) and 2 were highly susceptible (HS) to red rot. In nodal method of screening, 57 clones were identified as R and 17 were rated as S to red rot.

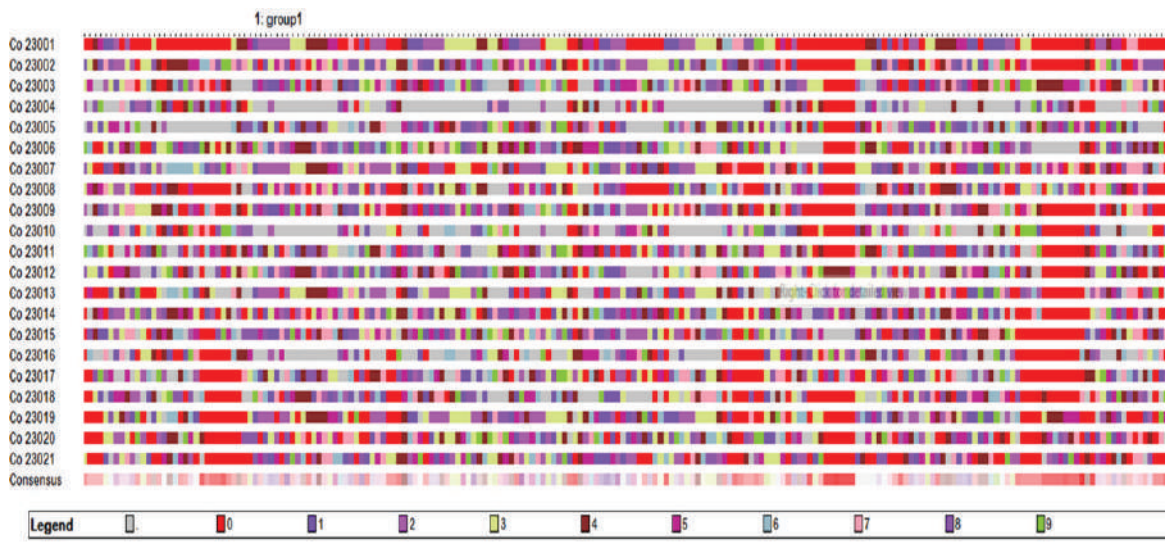
(V. Jayakumar and R. Selvakumar)

Screening for Smut: Out of the 74 PZVT clones evaluated for smut resistance along with resistance and susceptible standards, three clones *viz*., 2022-80, 2022-110 and 2022-214 were resistant (R), 6 clones were moderately resistant (MR), 8 clones were moderately susceptible (MS), 11 clones were susceptible (S) and 46 clones were found to be highly susceptible (HS)

(A. Ramesh Sundar and R. Ramesh)

Botanical characterization and DNA Finger printing of elite selections and varieties

Botanical description of 2022 'Co' canes series was completed and characterization is initiated for 21 'Co' canes of 2023 series (Co 23001 to Co 23021) developed at Coimbatore. The molecular fingerprints of the recently developed ten 'Co' canes of 2023 series were completed. The molecular fingerprints of Co 16006, Co 17018 which were identified for release were developed. On payment basis, the molecular fingerprints of CoH 13263 and CoH 17261 were also developed.



Graphical representation of molecular profile of 23 series Co canes (Co 21003 to Co 23021)

(H.K. Mahadeva Swamy and S. Alarmelu)

Identification and testing of short duration sugarcane clones

Physio-chemical parameters associated early sucrose accumulation were evaluated in short duration sugarcane clones, four short duration clones (Agl 2018-24, Co 09004, Co 11015, SDC 2020-12) along with two midlate varieties (Co 99004, Co 12009) in replicated trials planted at bi-monthly intervals (Feb. 2024, Apr. 2024, June 2024, Aug 2024, Oct. 2024 and Dec. 2024). Physiological observations including number of tillers, SPAD chlorophyll index, leaf area, canopy temperature depression, cane height, cane girth and number of internodes are recorded at monthly intervals starting from 6th month. Biochemical parameters such as total sugars, reducing sugars, non-reducing sugars and starch were estimated in the leaf, cane and juice samples. Activity of sucrose metabolising enzymes such as sucrose synthase, sucrose phosphate synthase, acid invertase and neutral invertase were estimated in the leaf and cane tissues. Juice quality parameters were also estimated at monthly intervals beginning from the 6th month. In February 2024 planted crop, early maturing genotypes

recorded 56.91%, 41.17% and 30.50% total sugars in cane at six, seven and eight months respectively, whereas it was 58.09%, 33.36% and 28.00% respectively in the mid-late varieties. At 6th month age, the acid invertase and neutral invertase activity was 2.64 µmol g^{-1} FW h^{-1} and 3.24 µmol g^{-1} FW h^{-1} in early maturing genotypes as against 3.94 µmol g^{-1} FW h^{-1} and 2.71 µmol g^{-1} FW h^{-1} in the mid-late maturing varieties. Sucrose phosphase synthase and sucrose synthase activity in cane at 6th month was 0.29 µmol g^{-1} FW h^{-1} and 0.31 µmol g^{-1} FW h^{-1} in early maturing genotypes as compared to 0.21 µmol g^{-1} FW h^{-1} and 0.17 µmol g^{-1} FW h^{-1} in mid-late maturing varieties.

(R. Karuppaiyan and V. Krishnapriya)

Evaluation of elite clones for identifying promising location specific sugarcane varieties

Maharashtra: Twenty-three test entries were evaluated along with the zonal check Co 86032 and two local standards CoVSI 08005 and CoM 0265 at the factory farm of M/s. Sahakar Maharshi Shankarrao Kolhe Sahakari Sakhar Karkhana Ltd., Kopargaon, Maharashtra. Among the clones, pol % (juice) ranged from 18.11% (Co 18023) to 21.49% (Co 20010). All clones recorded higher pol% and CCS% than the standard CoM 0265 with 17.82% and 12.43% respectively. Thirteen clones recorded higher pol% and CCS% than Co 86032 with 18.64% and 13.45%, respectively. CoM 0265 recorded cane yield and sugar yield of 119.21t/ha and 14.87t/ha, respectively. Clones *viz.*, Co 14027 (119.37t/ha), Co 15020 (135.00t/ha), Co 18001 (119.78 t/ha), Co 19008 (123.24t/ha), Co 20005 (124.19 t/ha), Co 20006 (136.00t/ha), Co 21003 (134.39 t/ha) recorded better cane yield than CoM 0265. Sixteen clones recorded higher cane yield and sugar yield than Co 86032 with 92.56 t/ha and 12.04 t/ha respectively. Considering the juice quality and yield parameters, six clones *viz.*, Co 19008, Co 20005, Co 20010, Co 20011, Co 21003 and Co 21011 and the recent released varieties *viz.*, Co 14012 and Co 18009 were advanced for further evaluation.

(V. Sreenivasa and C. Appunu)

Karnataka: Twelve entries *viz.*, Co 21003, PZVT 2020-76, PZVT 2020-49, PZVT 2020-152, PZVT 2020-28, PZVT 2020-23, PZVT 2020-127, PZVT 2020-121, PZVT 2020-67, PZVT 2020-147, PZVT 2020-15, PZVT 2020-117 along with two standards Co 86032 and CoC 671 were evaluated at S. Nijalingappa Sugar Institute (SNSI), Belagavi. The entries Co 21003 (22.27, 148.18), PZVT 2020-127 (22.00, 141.86), PZVT 2020-121 (21.00, 147.31) were found superior to Co 86032 (15.89, 125.20) with respect to CCS yield (t/ha) and cane yield (t/ha) respectively. The trial was ratooned during 2024 to study the ratoon performance of these clones.

(V. Sreenivasa, K. Mohanraj and H.K. Mahadeva Swamy)

Breeding special varieties for high biomass and total sugars for cogeneration, ethanol and forage production

Cogeneration and ethanol production: Three newly developed Type II energy canes *viz.*, SBIEC 20001, SBIEC 20002 and SBIEC 20003 were planted in larger plots for evaluation. Tissue culture seedlings of SBIEC 14006 were planted to evaluate their fibre content, biomass production and juice quality. Estimation of cane characters at 10th month indicated that single cane weight with trash and tops was 1.32 kg, single cane weight was 1.22 kg with 7.70 % Brix and an extraction % of 27.38. The harvestable biomass yield was 266.64 t/ha. The mean cane height, cane diameter and number of internodes were 376 cm, 2.19 cm and 34 respectively. The mean leaf length and width were 132.19 cm and 4.70 cm respectively. The vigour was found to be better in tissue culture raised seedlings. Licensing of Energy Cane Variety SBIEC 14006 was granted to Hriday Hydrogen Power Private Limited, Pune during November 2024.

(P. Govindaraj, K. Elayaraja and M.R. Meena)

Nutritional evaluation, improvement and utilization of newer feed resources for livestock production

Development of alternate source of feed stocks: Nine selections from the cross Napier grass x Commercial Sugarcane, four selections from the cross Napier grass x *Erianthus arundinaceus* were made and the selected clones were transplanted in field for further study.

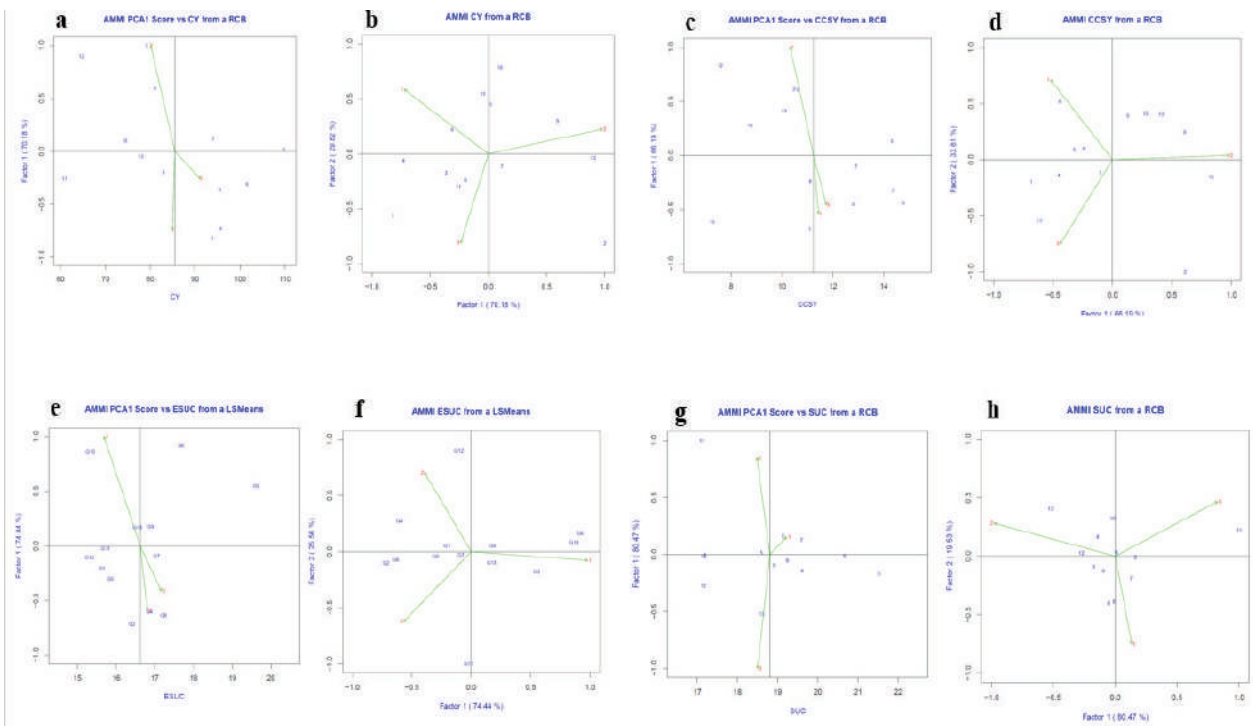
Evaluation of new fodder clones: Twelve newer fodder clones derived from backcrosses involving commercial sugarcane, *Erianthus arundinaceus* as one of the parents (Fodder Bajra, Cumbu Napier Hybrid, *Pennisetum purpureum* are other parents involved in their pedigree) were evaluated. These fodder clones were responsive for four cuttings per year at an average interval of 75-80 days. The green fodder yield (fresh weight) of the standard CNH CO 3 was 257.28 t/ha (total of four cuttings). The new fodder source (Selection 11, chromosome 2n=14) recorded higher green fodder yield (277.97 t/ha) than the standard. Plant samples

were drawn and sent for analysis of proximate principal compounds.

(R. Karuppaiyan and P. Govindaraj, ICAR-SBI Coimbatore; Vijay K. Yadav, S.B. Maity, K.K. Singh, Sultan Singh, P. Koli, ICAR-IGFRI, Jhansi)

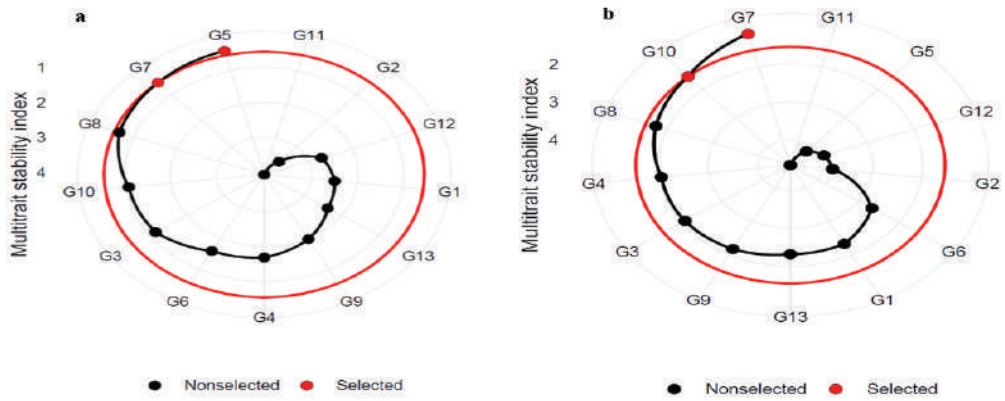
Identification of superior sugarcane varieties suitable for different agro-eco climatic regions of Tamil Nadu (ART/MLTs in collaboration with TNAU)

Multi-location Trial (2023-24) – II plant and Ratoon: The second plant trial was planted with seven test entries *viz*., Co 13003, Co 15003, Co 17001, C 16337, C 16338, G 2014-036 and SI 2014-049 along with six standards *viz*., Co 86032, Co 11015, CoC 13339, CoG 6, CoG 7, and TNAU (SC) Si 8 at ICAR-SBI, Coimbatore. First plant crop with seven test clones and six standards was ratooned during February 2023. Pooled analysis of two plant and one ratoon crops data revealed that Co 11015 was the best standard with 14.35 t/ha sugar yield and 95.51 t/ha of cane yield. Among the test entries, Co 17001 (14.77t / ha) was superior to Co 11015 for sugar yield because of its higher cane yield (101.57 t/ha). Co 15003 (14.31 t/ha) was the other entry that recorded higher sugar yield than Co 86032 (12.91 t/ha) . For cane yield, besides Co 17001, two entries *viz*., Co 15003 (109.78 t/ha) and Co 13003 (95.67 t/ha) were superior to Co 86032 (93.99 t/ha). None of the test entries was superior to Co 11015 for sucrose content (21.52 %) and CCS (15.04%). However, Co 17001 with 14.52 % CCS and 20.67 % sucrose content was found to be better than Co 86032 (13.74 % CCS and 19.60 % sucrose content). AMMI biplot analysis revealed that the genotypes Co 17001, CoC 13339, Co 86032 were stable for cane yield. For CCS yield, Co 86032 and CoC 13339 were found to be stable across locations.



AMMI Biplots (a) PC1 vs CY (Cane yield) (b) PC1 vs PC2 CY (Cane yield) (c) PC1vs CCSY (CCS yield) (d) PC1 vs PC2 for CCSY (CCS yield) (e) PC1 vs ESUC (Sucrose at 10th month) (f) PC1 vs PC2 for ESUC (Sucrose at 10th month) (g) PC1 vs SUC (Sucrose at 12th month) (h) PC1 vs PC2 for SUC (Sucrose at 12th month)

(C 16337 (G1), C 16338 (G2), Co 11015 (G3), Co 13003 (G4), Co 15003 (G5), Co 17001 (G6), Co 86032 (G7), CoC 13339 (G8), CoG 6 (G9), CoG 7 (G10), G 2014-036 (G11) and SI 2014-049 (G12) and Si 8 (G13))



Multi-trait stability analysis (a) Considering SUC, CCS%, CY and CCSY (b) Considering all the traits under study.

AMMI stability parameters such as ESI (Environment stability index), EV (Average of the squared eigen vector values), SIPC (Sums of the absolute value of the Interaction Principal Component scores) identified four stable genotypes *viz*., Co 17001, Co 15003, Co 86032 and Co 11015 for cane and CCS yield. Multi-trait stability analysis revealed that the genotypes Co 15003 and Co 86032 were highly stable for the traits *viz*., sucrose, CCS percent, cane yield, CCS yield. AMMI and GGE analysis highlighted the genotypes Co 17001 and Co 15003 have better stability than the standards Co 11015 and Co 86032 for sucrose content, cane and CCS yield.

Adaptive Research Trial (2023-24) – II plant and Ratoon:
Three test entries (C 2015-095, Co 15020, G 11035) along with the six standards (Co 86032, Co 11015, CoC 13339, CoG 6, CoG 7, TNAU (SC) Si 8) were evaluated at three locations *viz*., Sathyamangalam, Appakudal and Odapalli.

At Appakudal, CoG 7 recorded the highest cane (238.67 t/ha) and sugar yield (25.6 t/ha) in the second plant crop. Two entries *viz*., G 11035 with 176.89 t/ha cane yield and 20.30 t/ha sugar yield and Co 15020 with 156.44 t/ha of cane yield and 19.50 t/ha of sugar yield were superior to the commercial variety Co 86032 which recorded 124.89 t/ha and 16.20 t/ha of cane and sugar yield respectively. In the ratoon trial, CoG 7 was the best standard for cane yield (153.54 t/ha) and CoC 13339 for sugar yield (15.90 t/ha). G 11035 recorded the highest cane yield (158.97 t/ha) and sugar yield (18.30 t/ha). Besides G 11035, Co 15020 (121.65 t/ha and 13.90 t/ha) was found superior to Co 86032 (116.67 t/ha and 12.20 t/ha) for cane yield and sugar yield respectively.

At Bannariamman Sugars, Sathyamangalam, none of the test entries was superior to Co 11015 (212.59 t/ha) for cane yield in second plant trial. However, Co 15020 (172.22 t/ha) was on par with Co 86032 (172.96 t/ha) for cane yield. In the ratoon trial, Co 15020 (156.18 t/ha and 20.83 t/ha) and G 11035 (153.28 t/ha and 20.80 t/ha) were superior to Co 11015 (142.77 t/ha 20.15 t/ha) for cane yield and sugar yield respectively.

At Ponni Sugars, CoG 7 recorded the highest cane yield of 136.88 t/ha while the highest sugar yield was recorded by Co 11015 (17.36 t/ha) in second plant trial. Co 15020 with cane yield of 133.11 t/ha and sugar yield of 15.00 t/ha was found superior to the commercial variety Co 86032 which registered 128.31 t/ha cane yield and 15.04 t/ha sugar yield. In the ratoon trial, CoG 7 was best standard for cane yield (140.61 t/ha) and Co 11015 for sugar yield (17.79 t/ha). Co 15020 (145.37 t/ha and 16.05 t/ha) and G 11035 (136.84 t/ha and 14.98 t/ha) were better than the commercial variety Co 86032 (126.98 t/ha and 14.87 t/ha) for cane and sugar yield respectively.

Pooled analysis of two plant and ratoon crops indicated Co 15020 as the best genotype with a high mean cane yield of 160.62 t/ha and 20.24 t/ha of sugar yield recording 14.50 % and 19.06 % improvement over the commercial variety Co 86032 (140.28 t/ha and 17.00 t/ha).

(A. Anna Durai, K. Elayaraja, K. Gopalareddy and Adhini S. Pazhany)

Marker-assisted selection in sugarcane for drought tolerance and red rot resistance

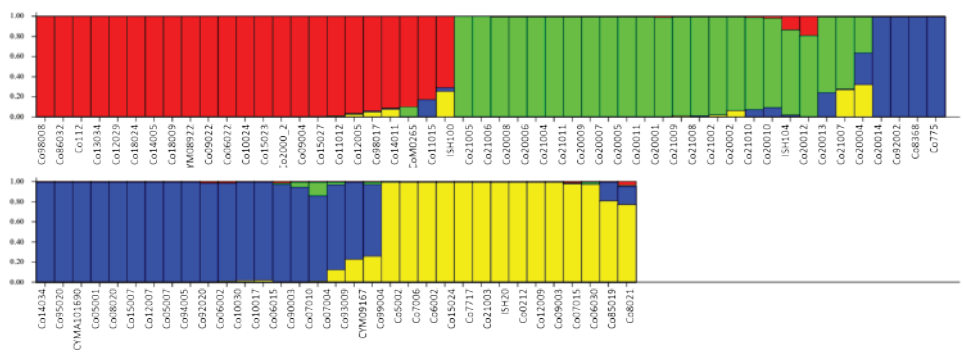
Available breeding materials were pooled for the study to validate the candidate genes and to identify the robust markers for drought tolerance, the. Popular varieties, recent 'Co' canes, genetic stocks and clones with known

tolerance or sensitivity to drought constituted the study panel. Ninety genotypes were evaluated under imposed drought condition. The variation found under drought condition for the traits *viz*., cane biomass, tillers per row, cane height, cane diameter, internode length, internode number, top weight, cane weight, dry top weight, dry cane weight are given in Table. The results on the molecular diversity analysis indicated that the study panel with sixteen clones was highly diverse and the dissimilarity coefficient varied from 0.5 to 0.9, distributed into four sub population with an average gene flow of 0.29 between them. The genome wide marker trait association analysis revealed the markers POM1, KGM, SNCA1, and DREB1A as promising markers with phenotypic variance explained by them for the drought tolerance related traits varied from 8 to 19 %.

A panel of 204 genotypes was constituted by pooling the progenies derived from the different cross combinations and genotypes developed under the pre-breeding program using Mongetgayam, Aweta Green Sport, Laukona-15, White Transparent, Keong as one of the parents, to identify the markers associated with red rot. The panel was tested for red rot resistance using CF6 isolate by CCT for two years. Based on the red rot reaction against CF 6, the genotypes were grouped into Resistant (R) Moderately resistant (MR), moderately susceptible (MS) Susceptible (S), and highly susceptible (HS). The polymorphic markers were identified among the five bulks constituted as R, MR, MS, S, and HS. These polymorphic markers were used to genotype the entire panel and genome wide association analysis was done to identify the marker trait associations. The MLM based analysis indicated that the marker RGA 184 was promising and can be used in maker-assisted selection after further validation.

Variation found for drought related traits in the panel under drought condition

Statistic	Cane Biomass (kg)	Tillers per row	Cane height (cm)	Cane Diameter (cm)	Inter node length (cm)	Inter node Number	Top Weight (kg)	Cane weight (kg)	Dry Top weight (kg)	Dry Cane weight (kg)
Mean	0.88	25.13	105.09	2.60	8.46	4.66	0.30	0.59	0.08	0.14
Minimum	0.44	11.50	71.00	2.12	6.12	3.17	0.18	0.21	0.05	0.07
Maximum	1.41	38.00	152.67	3.15	11.87	6.22	0.77	0.94	0.14	0.22
C.D.	0.29	10.09	35.32	0.34	2.12	N/A	0.09	0.19	0.02	0.04
SE(m)	0.10	3.56	12.27	0.12	0.74	0.56	0.03	0.07	0.01	0.01
SE(d)	0.14	5.03	17.35	0.17	1.04	0.80	0.04	0.09	0.01	0.02
C.V.	16.28	20.02	16.51	6.49	12.32	17.11	14.13	15.74	10.24	13.86



Population structure of drought panel

(H.K. Mahadeva Swamy, G. Hemaprabha, K. Mohanraj, C. Appunu, K. Gopalareddy, P. Malathi and R. Manimekalai)

Selection and evaluation of multi-purpose sugarcane clones with high ethanol and bagasse yields for integrated sugar complexes

During February 2024, about 70 clones, each recording single cane weight of >1.50 kg (average 2.20 kg), were selected from ground nursery and clonal trials and planted in replicated trial. Twenty-seven clones showed S / HS reaction, while remaining 47 clones were either R or MR or MS to red rot through CCT. Data recorded at 8th and 10th month indicated eleven clones with single cane weight around 2.0 kg, high juice volume (close to 1.0 kg per stalk), MS/MR/R to red rot and moderate sucrose %.

Elite clones with high stalk weight and juice volume selected for further study

S. No	Clone	SCW (kg)		Pol % in Juice		Single cane Juice weight at 10m	Red rot rating-CCT (cf 671)
		8m	10m	8m	10m		
1	AA 2024-03	1.82	2.54	13.84	18.07	0.99	MR
2	AA 2024-05	2.03	2.28	14.74	20.75	0.99	MR
3	CA 2024-03	1.95	2.22	13.56	16.61	0.89	R
4	CA 2024-05	1.86	2.40	13.62	17.85	1.02	MR
5	CA 403	1.91	2.10	11.16	16.73	0.97	MR
6	HKM 201	2.41	2.08	15.74	18.99	1.32	MR
7	HKM 94	2.08	2.12	17.65	20.01	1.11	MS
8	KE 2024-01	2.46	1.97	14.83	19.35	1.33	MR
9	KE 2024-03	2.34	2.37	16.67	19.25	1.30	MS
10	RK 2023-86	2.38	2.34	15.47	18.83	1.36	MR
11	SA 2024-01	2.48	3.06	13.97	17.19	1.36	MR
	Standards						
1	Co 86032	1.52	1.92	16.52	19.19	0.80	MS
2	CoM 0265	1.85	1.93	13.39	18.83	1.12	MR

(R. Karuppaiyan, C. Palaniswami, M. Alagupalamuthirsolai and Adhini S. Pazhany)

Development of database management systems (DBMS) for improving breeding efficiency

The data of 'Co' canes starting from Co 205 to the recently developed 2022 series was compiled in an Excel sheet and a master information sheet was prepared. Data on missing entries was collected during 2023 and 2024 flowering seasons from the 'Co' cane plot. Sugarcane parental database was developed with different menu options. Sample data from the master sheet was loaded into the database.

Snapshots of sugarcane parental database

(R.T. Maruthi, Vinayaka, A. Anna Durai and K. Mohanraj)

Molecular profiling of sugarcane gene pool for brown rust and identification of novel genomic regions for rust in Bru 1 gene null background

Molecular profiling of 198 clones in the arrowing plot using *Bru1* gene-related marker revealed forty-two clones positive for *Bru1* and all of them were found free from rust. Out of 156 clones without the presence of *Bru1*, rust was observed in 51 clones and remaining were free from rust under natural incidence. These 105 genotypes with *Bru1* negative and rust free are the desirable candidates to identify the novel rust resistant genes in sugarcane. From the previous year crossing, 780 seedlings from the crosses Co 0238 x BO 91, Co 8353 x Co 12014, Co 15027 x CoPant 97222 and ISH 12 x CoH 70 were transplanted along with rust spreader parents in the field. In the current season, 18 crosses were made using desirable candidate clones with rust susceptible clones.

(K. Gopalareddy, H.K. Mahadeva Swamy and R. Selvakumar)

Enhancement of sugarcane germplasm and development of pre-breeding material

Maintenance at Coimbatore and Wellington

Two thousand two hundred and seventy-seven accessions were maintained at Coimbatore, which includes *Saccharum spontaneum* (1756), *Erianthus arundinaceus* (233), *Erianthus* spp. (178), allied Genera (62) and improved *Erianthus* for fibre (48). Forty-seven accessions collected from Arunachal Pradesh are being maintained at IARI Regional Station, Wellington.

This year, all the germplasm accessions of wild *Saccharum* spp. and allied genera were planted in our newly developed "ICAR-SBI Wild Sugarcane Germplasm Repository" during April, 2024, at ICAR-SBI, Coimbatore.

ICAR-SBI Wild Sugarcane Germplasm Repository

Flowering in Miscanthus spp. at ICAR-IARI Regional Station, Wellington

Maintenance of high-altitude collections from Arunachal Pradesh at IARI Regional Station, Wellington.

(S. Karthigeyan, S. Sheela Mary, Adhini S. Pazhany, (ICAR-SBI, Coimbatore); M. Sivaswamy [ICAR-IARI Regional Station], Wellington)

Maintenance of commercial hybrids and genetic stocks

A total of 1924 clones which includes 'Co' canes (1280), Co allied (16), foreign hybrids (52), ISH (283), IGH (37), PL (58), CD (84), CYM (94), IA (13), GU (1) and IND (6) were maintained at Coimbatore.

(K. Elayaraja and R.T. Maruthi)

National active germplasm maintenance

Seed material received from different centres were submitted for quarantine. 291 notified varieties and registered genetic stocks were maintained. During this period, twenty-six clones *viz*., GU-12-19, GU-12-21, GUK 14-48, Co 85019, Co 98017, Co 14005, Co 15002, Co 15025, Co 16030, Co 17001, Co 17004, Co 17008, CoP 11438, CoM 11086, CoM 13082, CoPant 12221, CoP 18437, CoP 20440, CoP 15437, Co Pant 12226, Co Pant 13224, CoS 16233, CoS 17231, CoSe 11453, CoLk 16466 and CoLk 15206 were assigned index number.

(C. Jayabose and S. Alarmelu)

Characterization, Evaluation and Cataloguing

Flowering behavior of S. spontaneum and allied genera

Recording of flowering data was initiated at weekly intervals from July 1st week onwards during 2023-24 season. Out of the 1756 *Saccharum spontaneum* planted in the ICAR-SBI Wild Sugarcane Germplasm Repository in Coimbatore during 2024, 835 accessions flowered during 1st of July, 2024 to 31st of December, 2024. Flowering behavior was observed for eight allied genera which includes 245 clones maintained in the germplasm field. Among them, eight clones started flowering during 2nd week of November, forty-two clones during 3rd week of December, seven clones during 4th January 2024, twenty clones during July 2024 and fourteen clones during August 2024. Eighty-eight clones of *Erianthus bengalense* started flowering from second week of August and extended up to to first week of December. Flowering was observed in eighteen clones of *Erianthus procerus* during 2nd week of September and extended till 4th week of November. All six clones of *Erianthus elephantinus* started to flower during first week of October and twelve clones of *Erianthus ravennae* started to flower during first week of September which extended up to second week of November, 2024.

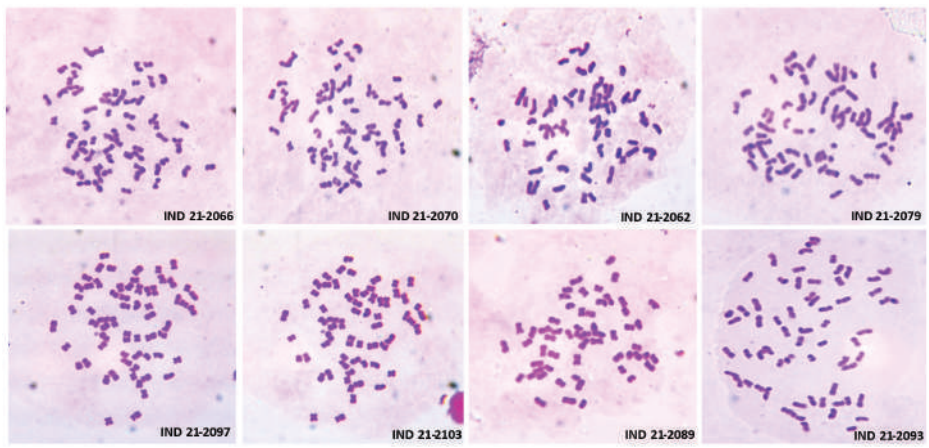
(C. Jayabose, S. Karthigeyan and Adhini S. Pazhany)

Cytological studies in *Saccharum* and allied genera-*S. spontaneum*

Somatic chromosome number (2n) was determined in forty clones of *S. spontaneum* (late flowering types) collected from South zone of India (Karnataka, Tamil Nadu and Andhra Pradesh). All clones except IND 21-2052 (2n=68), IND 21-2061 (2n=60), IND 21-2074 (2n=62) and IND 21-2100 (2n=62) had 2n=64.

Somatic chromosome (2n) number of *S. spontaneum* clones from South India

CLONE	2n	CLONE	2n	CLONE	2n
IND 21-2052	68	IND 21-2061	64	IND 21-2092	64
IND 21-2055	64	IND 21-2079	64	IND 21-2093	64
IND 21-2057	64	IND 21-2080	64	IND 21-2094	64
IND 21-2059	64	IND 21-2081	64	IND 21-2095	64
IND 21-2060	64	IND 21-2082	64	IND 21-2096	64
IND 21-2061	60	IND 21-2083	64	IND 21-2097	64
IND 21-2062	64	IND 21-2084	64	IND 21-2099	64
IND 21-2063	64	IND 21-2085	64	IND 21-2100	62
IND 21-2066	64	IND 21-2086	64	IND 21-2101	64
IND 21-2070	64	IND 21-2088	64	IND 21-2103	64
IND 21-2071	64	IND 21-2089	64	IND 21-2104	64
IND 21-2072	64	IND 21 2102	64	IND 21-2106	64
IND 21-2090	64	IND 21-2091	64	IND 21-2074	62
				IND 21-2056	64



Somatic chromosome (2n) number of South Indian S. spontaneum clones

In order to determine the basic chromosome number (x) through chromosome specific oligo FISH technique, twenty cytotypes of *S. spontaneum* were selected from germplasm. The somatic chromosome number has been determined in these clones.

Somatic chromosome (2n) number of different cytotypes of *S. spontaneum*

CLONE	2n	CLONE	2n
IND 01-1157	112	IND 16-1786	52
IND 03-1219	64	IND 16-1792	54
IND 03-1266	48	IND 16-1813	40
IND 11-1674	80	IND 16-1826	54

CLONE	2n	CLONE	2n
IND 11-1690	64	IND 17-1852	40
IND 15-1705	72	IND 18-1994	96
IND 16- 1804	54	IND 19-2028	80
IND 16-1749	54	IND 21- 2102	64
IND 16-1761	64	IND 21-2056	64
IND 16-1770	72	IND 21-2061	64

(V.P. Sobhakumari)

Floral biological and cytological characterization of *Erianthus*

51 out of 64 clones flowered during this season. Rare flowering clones such as IJ 76-400, IJ 76-404, IJ 76-411, IJ 76-476, IJ 76-502 flowered during 2024 season. Maximum flowering of 52% was observed in IK 76-80 and 41% in *Erianthus arundinaceus* Sarkender. Number of days taken from symptom appearance to panicle appearance ranged from 9.1(US3-1) to 18 days (SES 189). Panicle appearance to tip appearance varied from 8.0-15.0 days. Days for tip emergence to anthesis were from 4.5-9.0 days. Meiotic studies in 10 clones of *E. arundinaceus* indicated predominance of bivalents. Laggards were observed from 0-10 with unequal distribution of chromosomes. Secondary association of bivalents were also noticed. Data on thirty-six descriptors in 180 clones of *E. arundinaceus* were incorporated in DELTA software. The clone SES 288 was distinct from other clones with dark purple internodes. Beaked buds were noticed in IND 99-871 and IND 99-893. *Erianthus arundinaceus* thornless was unique with conoidal internodes while internodes were arranged in zig-zag fashion in SES 159 and IND 99-884 clones.

(A. Suganya)

Evaluation of sugarcane germplasm for biotic and abiotic stresses at Coimbatore

Saccharum spontaneum: Forty *S. spontaneum* accessions identified as drought tolerant in the preliminary evaluation were planted in split plot design in two replications as control and drought treatments along with standards for evaluation at Agali centre. Nine genotypes *viz.*, SES 32A, SES 69, SES 49, SES 297A, IND 99-879, IND 99-847, IND 99-882, IND 04-1372 and US 57-19-1 recorded positive Canopy Temperature Depression (CTD) values exhibiting drought tolerance. Twenty-two genotypes recorded high fresh biomass under drought stress. Under drought condition the average fresh biomass per clump was 5.90 Kg while in control it was 10.22 Kg. Genotypes *viz.*, IMP 1312, IND 03-1307 and IND 03-1229 recorded less than 10% reduction in the fresh biomass under drought stress compared to control.

One hundred and thirty-seven *S. spontaneum* accessions were evaluated in augmented design along with two standards. Fifteen clones recorded less than 20% reduction in number of tillers/clump and total fresh biomass under drought condition compared to control. The mean fresh biomass/clump in drought treatment was 4.44 Kg while it was 13.82 Kg in control. In case of canopy temperature depression, 65 genotypes recorded positive CTD values and nine genotypes had higher values than the best standard *S. spontaneum* Cbe. Based on these observations, forty-five clones were found promising under drought stress and advanced for evaluation in a replicated trial.

Erianthus arundinaceus: From a panel of ninety-six *E. arundinaceus* clones evaluated for drought stress tolerance in field conditions, ten clones were selected and evaluated for salinity stress tolerance in pot culture. Salinity screening at formative phase was carried out after 90 days of planting under 16 dSm^{-1} salinity treatment. Salinity treatment was given by irrigating saline water at regular intervals. The saline water was prepared by mixing desired amount of NaCl, Na_2SO_4, $CaCl_2$. $2H_2O$ in the ratio of 2:2:1. After one week of saline water treatment, morphological and physiological data were recorded in treated as well as control plants. The study revealed that *Erianthus* clones exhibited a wide range of physiological and biochemical responses to salinity. The clones *viz.*, IND 99-889, IND 99-890, SES17, SES 79 and SES 206 exhibited high levels of tolerance against salt stress in terms of higher stability of photosynthetic pigments, high biomass, higher accumulation of proline and lower lipid peroxidation.

Among the twenty clones of *E. arundinaceus* evaluated for red rot resistance, ten clones showed R reaction and ten clones showed MR reaction.

(H.K. Mahadeva Swamy, R. Valarmathi, T. Lakshmi Pathy (from 30.9.2024) R. Gobu and R. Arun Kumar)

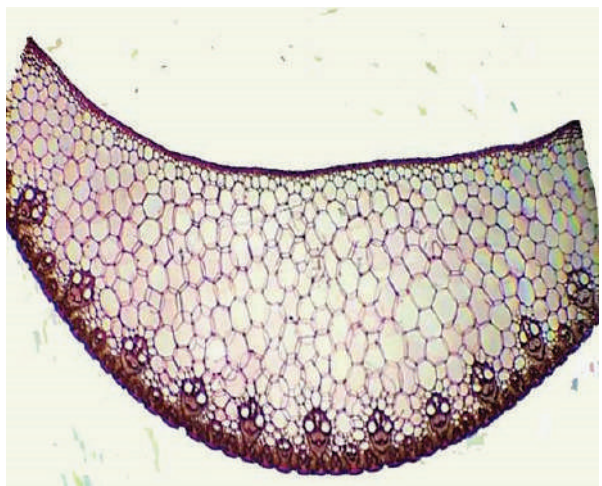
Anatomical characterization of *Saccharum* complex and core collections

Thirteen clones of *Saccharum complex* members *viz*., *S. officinarum* (Keong and Green german), *S.barberi* (Dark pintaria and Barathua), *S. sinense* (Chuckche and Ikhre), *S. robustum* (NG 77-23 and NG 77-24), S. *spontaneum* (IND 09-1509 and IND 03-1205), *Narenga*, *Sclerostachya* and *Erianthus arundinaceus* have been characterized for leaf anatomy, internode anatomy and micromorphological features of adaxial and abaxial epidermis of leaf and internode.

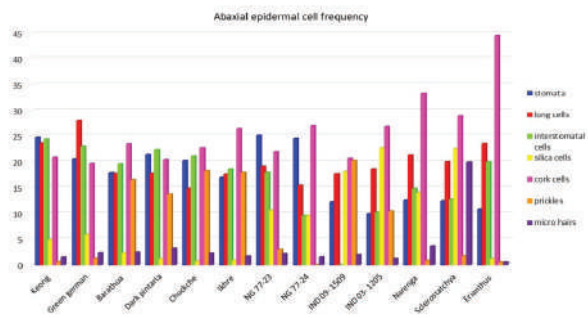
Culm anatomical studies in *Saccharum* species revealed intact peripheral vascular bundles in *S. robustum* and *S. spontaneum*, while in other species they were distantly arranged. These two species consisted high number of medium and large bundles. *S. sinense* possessed very small peripheral vascular bundles while *S. barberi* had lower number of small bundles. In the remaining species, small and medium bundles were distributed at higher frequency. Bundle sheath layers ranged from 5-11. In *S. spontaneum*, 1-2 protoxylem was observed while the shape of metaxylem was round to oval.

In leaf blade anatomy, variation in keel bundle arrangements, shape and girders were noticed. *S. officinarum* had a smaller number of sclerenchyma girders. Bulliform cells ranged from 2-7. *S. robustum* possessed 3-5 bulliform cells while *S. officinarum* had 2-4 cells. *S. spontaneum* possessed vertically large epidermal cells. Quaternary vascular bundles were observed in *Narenga*. Sclerenchyma cap was noticed in the primary vascular bundles of *Sclerostachya*

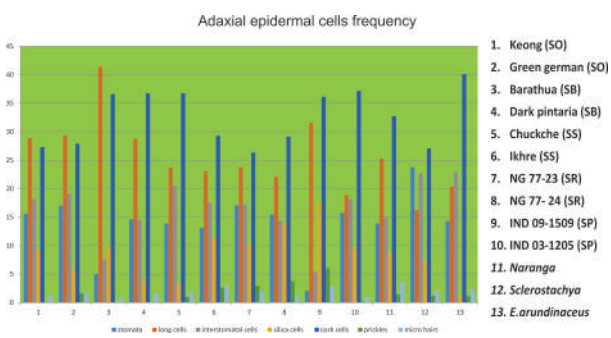
Leaf micromorphological studies in the species of *Saccharum* revealed interlocked large prickles in *S. spontaneum*. High frequency of pointed hooks with microhairs was seen in *S. barberi*. Long cells of *S. robustum* were sinuous. Silica cells of *S. sinense* were dumb bell shaped. Elongated bulliform cells were observed in *S. officinarum*. In other genera, prickles were present in *Narenga* and *Sclerostachya* while it was absent in *E. arundinaceus*. Saddle and dumbbell shaped silica cells were seen in the epidermis of *Narenga* and *Sclerostachya* whereas only saddle shaped silica cells was noticed in *E. arundinaceus*. More number of inter-stomatal layers were observed in the abaxial epidermis of *E. arundinaceus*.



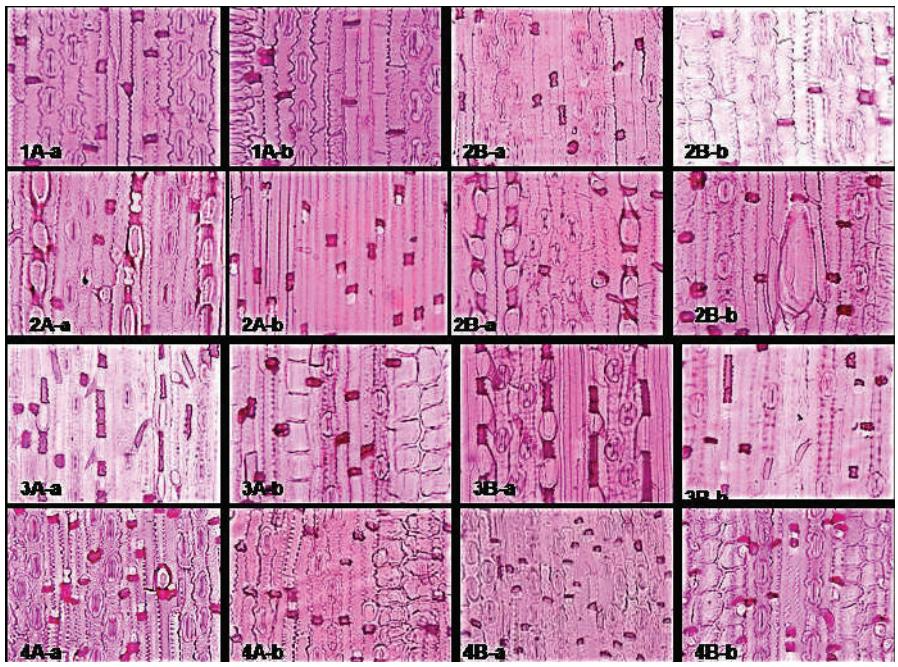
Mid-rib anatomy of S. barberi



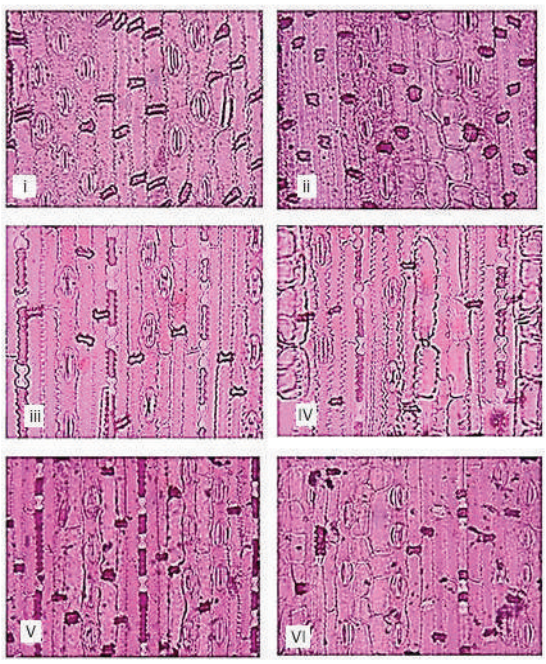
Abaxial epidermal cell frequency (in internodes) of Saccharum species



Adaxial epidermal cell frequency (in leaves) of Saccharum species



Leaf micromorphology of Saccharum species. 1A- 1B: (S. o – Keong, Green germen), 2A- 2B: (S.b- Barathua, Dark pintaria), 3A- 3B: (S.si- Chuckche, Ikhre), 4A- 4B: (S.r – NG 77- 23, NG77- 24), 5A- 5B: (S.sp- IND 03- 1205, IND 09- 1509), a- Adaxial epidermis, b- Abaxial epidermis.



Leaf micromorphology of Erianthus, Narenga, Sclerostachya: i-ii: Abaxial and adaxial epidermis of E. arundinaceus, iii- IV: Abaxial and adaxial epidermis of Narenga, V-VI: Abaxial and adaxial epidermis of Sclerostachya

(A. Suganya)

Germplasm maintenance, hybridization and off-season nursery at Agali

Germplasm maintenance: 1394 germplasm accessions including 'Co' canes, Co-allied clones, exotic hybrids, inter-specific and inter-generic hybrids, active collection of *Saccharum officinarum*, *S. barberi*, *S. sinense*, *S. robustum*, *Erianthus* spp, *Sclerostachya* and *Narenga* are maintained in the field.

(R.T. Maruthi)

Flowering during 2024 season: Out of 1394 germplasm clones, 877 accessions flowered with 62.91% flowering intensity during 2024. Among the 205 *S. officinarum* clones maintained at National Distant Hybridization Facility (NDHF), Agali, 48 clones (23.41%) flowered. Seven clones of *S. sinense*, five clones of *S. robustum* and two clones of *S. barberi* flowered during the season. The intensity of flowering in 'Co' canes and Co-allied clones was 80.57%. Anthesis started from 17th September, 2024 and lasted up to 28th December, 2024. *S. officinarum* clones *viz.*, Mongetgayam and Naz, exotic clones *viz.*, LF 89-2064, Suphan-50 and KM 436 were the early flowering clones which flowered during 3rd week of September 2024.

Hybridization: 254 crosses were made at NDHF at Agali centre during 2024 crossing season. Twenty-one AICRP(S) centers (Anakapalle, Buralikson, Cuddalore, Faridkot, Lucknow, Kapurthala, Mandya, Motipur, Navasari, Padegaon, Pantnagar, Powarkheda, Pune, Pusa, Sankeshwar, Seorahi, Shahjahanpur, Rudrur, Thiruvalla, Uchani and Vuyyuru) visited the NDHF and utilized the facility. A total of 105 crosses were made for the participating centers.

(R.T. Maruthi and A. Anna Durai)

First Clonal trial: Thirty-six clones were selected from 150 clones in first clonal stage based on Brix% (≥ 22%) and better cane parameters. Most of the selections were from crosses involving 'Co' canes with ISH/IGH and Co-allied clones.

Second clonal trial: Eight clones were selected from the second clonal trial based on the superior cane parameters and juice sucrose% of >21% at harvest and promoted to PZVT.

Off Season Nursery: ICAR-NRC Banana, Trichy, under the project 'Improvement of banana through conventional breeding' are maintaining 750 plants from 75 unique and breeding potential varieties/accessions at Agali centre. 120 bunches were hybridized with various cross combinations and a total of 747 hybridized seeds were collected from 30 successful hybridized bunches.

(R.T. Maruthi)

Developing trait specific genetic stocks with biotic and abiotic stress tolerance, quality and yield traits in sugarcane through pre-breeding

Identifying multi trait genetic stocks with improved Saccharum genetic base

Forty-five clones were selected and planted in a split plot design along with standards CoM 0265, Co 85019 and Co 10026 for evaluation under drought and normal conditions in two locations (Coimbatore and SBIRC, Agali) during February 2023. Drought stress was induced during formative phase of the crop by withholding irrigation. The drought stress was initiated at 60 days after planting and continued up to 150 days. Germination was satisfactory and phenotypic traits *viz*., plant height (cm), cane diameter (cm), number of millable canes (NMC) per row, yield/row (kg), number of internodes, internode length, dry matter production, canopy temperature depression, chlorophyll fluorescence and relative water content was recorded at 150 days of crop age. Mean yield at stress condition was 38.54 kg/row which ranged from 11.81 kg/row to 91.58 kg/row. Under non-stressed condition, the mean yield of the clones was 51.28 kg/row with a range of 28.50 to 95.46 kg/row. There was significant reduction in the both yield and quality indices. A maximum of 52% reduction was recorded for cane volume followed by NMC/row (35.46 %) and cane yield (40.92 %) under drought. Among the clones tested for red rot by CCT, 25.24 % of the clones were moderately resistant to red rot. One clone *viz*., SA 14-25 entered PZVT testing.

A significant decline in physio-morphological traits was observed under drought stress which lasted for a period of two months during the formative phase. Number of tillers, leaf weight, sheath weight, stem weight, TDM (total dry matter), leaf number, number of green leaves, leaf length, leaf width, and LAI of sugarcane under drought stress showed a decline of 44%, 77%, 74%, 80%, 78%, 55%, 72%, 11%,14% and 59% respectively compared to sugarcane grown under control or ambient condition. Under drought stress, three clones had significantly better TDM compared to other drought tolerant clones and standards (Co 85019 and Co 10026) signifying their drought tolerance. The hybrids showed relatively higher canopy temperature in drought condition than under irrigated condition.

Eleven sugarcane hybrids with improved germplasm of *S. officinarum* and *S. robustum* were evaluated under both drought and normal conditions in tropical and sub-tropical regions. Severe drought stress was observed in both locations exhibiting a reduction in cane yield and its related traits. GGE analysis under stress conditions indicated that the clone 14-90 performed well in all eight environments. Seven stable clones, namely, SA 14-161, SA 14-111, SA 14-90, SA 14-58, SA 14-34, SA 14-124 and SA 14-83 exhibiting adaptive yield enhancing traits under drought were identified along with resistance to red rot. The clone SA 14-90 performed well both under tropical and sub-tropical regions indicating its stability across locations for cane yield and juice quality traits.

(S. Alarmelu, S. Sheelamary, R. Arunkumar and Adhini. S. Pazhany)

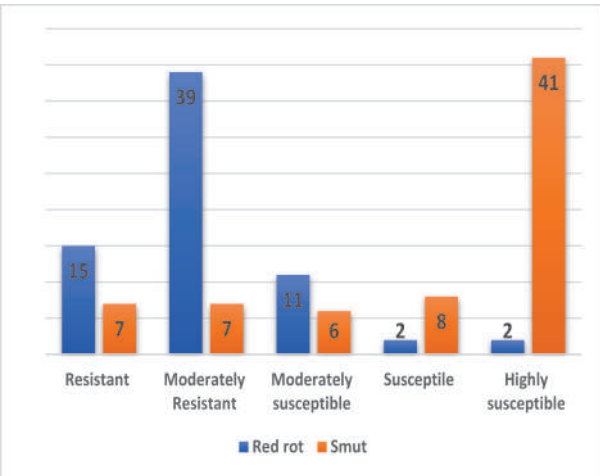
Developing trait specific genetic stocks for biotic and abiotic stress tolerance utilizing novel *Saccharum* germplasm

Hybridization: Twenty-four crosses were made using newly developed ISH clones as female parents and Co 775, Co 16018, Co 22012, Co 19014, CoVC 14061, Co

21006, Co 94008 and CoT 8201 as male parents during 2024 flowering season.

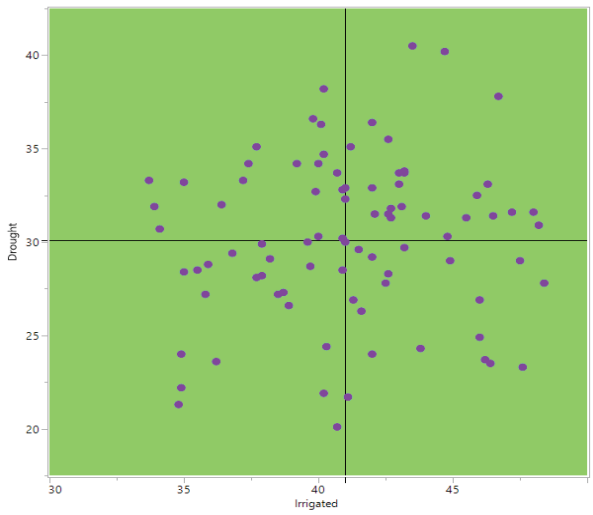
Ground nursery: 1095 seedlings of twenty-six second generation backcrosses and fifteen first generation back crosses were transplanted in ground nursery.

Screening for red rot and smut resistance: One hundred and ninety-seven clones developed utilizing different accessions of *Saccharum* complex background were screened with the mixed inoculums of CF06 and CF 94012 isolates of red rot pathogen by controlled condition testing method. Sixty-nine clones along with two susceptible checks (CoC 671 and Co 94012) were screened for red rot reaction under field condition through plug method by inoculating with CF06 pathotype and for smut resistance with Co 6806 as resistant check while Co 97009 and Co 96007 served as susceptible checks. Fifteen genotypes exhibited resistant reaction, thirty-nine clones were moderately resistant, eleven were moderately susceptible, two were susceptible and two were highly susceptible to red rot. For smut, seven clones were found to be resistant, another seven clones were moderately resistant, six were moderately susceptible and eight were susceptible. Most of test clones (41) were highly susceptible to smut pathogen



Reaction of the new interspecific hybrids to red rot and smut pathogens

Screening for drought and salinity tolerance: Forty-nine interspecific hybrids were planted in a Randomised Block Design along with two susceptible standards *viz.*, Co 775 and Co 8021 and two tolerant standards *viz.*, Co 85019 and CoM 0265 in two replications at ICAR-SBI, Coimbatore and eighty-one entries evaluated during 2023-24 were ratooned at ICAR-SBI RC, Agali. Characters contributing to cane yield and physiological parameters like SPAD values and relative water content were observed in these clones under irrigated and less irrigated conditions. Variability observed in SPAD values under less irrigated conditions in relation to normally irrigated situation is presented



SPAD values under drought and irrigated condition

All the juice quality characters were greatly influenced by reduced frequency of irrigation as compared to the cane yield contributing traits. Three clones *viz.*, TSGS 20-80, TSGS 22-327 and TSGS 20-24 did not show any significant reduction in single cane weight due to drought. Similarly, five clones *viz.*, TSGS -49, TSGS 20-76, TSGS 20-116, TSGS 20-70 and TSGS 20-13 recorded stable sucrose content in both irrigated and drought conditions.

(A. Anna Durai, A.J. Prabakaran, V. Sreenivasa, R.T. Maruthi, H.K. Mahadeva Swamy, K. Mohanraj, R. Selvakumar, V. Jayakumar, A. Ramesh Sundar, K. Chandran and R. Arun Kumar)

Developing trait specific genetic stocks with *Erianthus* genetic base

Genetic stocks submitted to ICAR-NBPGR, New Delhi: Two potential genetic stocks *viz.*, GU 12-19 and GU 12-21 involving *Erianthus procerus* were registered with ICAR NBPGR, New Delhi. The clone GU 12-19 was approved for excellent winter sprouting potential and red rot resistance and GU 12-21 for broad spectrum resistance to red rot disease and winter sprouting potential.

GU 12-19

GU12-21

Fluff sowing and raising BC_3 progenies: The fluff of thirty backcrosses involving *E. procerus* was sown and 1516 BC_3 progenies were raised. Maximum number of 360 seedlings were obtained from the cross GU19-1 x Co 11015.

Evaluation of BC_2 progenies for water deficit stress: Thirteen BC_2 progenies involving *E. procerus* were planted in a split plot design for evaluation under water deficit stress. The stress was induced by withholding the irrigation from 60DAP onwards till 150DAP. The clones were evaluated for cane yield traits and juice quality at 12 months. Maximum reduction was observed for single cane weight with 30.96% where it was 45.71% in commercial canes. The mean juice sucrose % was 4.64% lower under drought. The clone GU 19-4 recorded 19.84% juice sucrose under control. There was significant difference between both the treatments for fiber content. The mean fiber content in control was 15.52 % where as it was 16.89% in the drought. The clone GU 19-45 recorded the highest fiber content of 18.90%.

Screening for red rot resistance: Twenty-five BC_2 progenies involving *Erianthus procerus* were screened for red rot resistance along with two susceptible checks against CF06 pathotype under field condition by plug method of inoculation. Among 25 screened genotypes, one exhibited resistant reaction, eleven were moderately resistant, ten were moderately susceptible and three were susceptible to red rot. In addition, fifty-six BC2 progenies were evaluated for red rot resistance using cf 671+cf 94012 mixed inoculum under CCT and 26 clones were moderately resistant

(K. Mohanraj, A. Suganya, H.K. Mahadeva Swamy, A. Ramesh Sundar and V. Jayakumar)

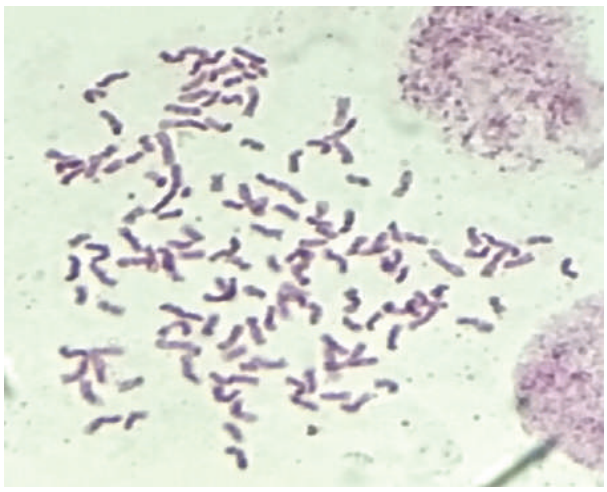
Improvement of elite interspecific hybrids derived from different cytotypes of *S. spontaneum* through nobilisation with typical clones of *S. officinarum* (2n=80)

Hybridisation and ground nursery: About 45 crosses were effected using *in-vitro* rejuvenated plants of IND 04-1377 and IJ 76-314, typical clones of *S. officinarum* (Laukona, IJ 76-314, IJ 76-564)/Co canes and elite hybrids at Coimbatore and Agali. The genetic stocks *viz.*, AS 04-635, AS 04-2097, AS 04-1687 tolerant to cold, drought and water logging were backcrossed with Co 11015 and CoC 671. 220 seedlings showed good establishment in the ground nursery. Thirty-nine seedlings were obtained from the cross of IJ 76-314 TC3 x Co 86032. Two tissue culture derived plants of NG 77-154 showed symptom appearance in November III week and further advancement of flowering did not occur in these plants.

Fifty-four backcrossed hybrids were evaluated at 10 months. High variability was observed for NMC (38.92%) and plant height (41.92%). Sucrose values of the hybrids ranged from 6.5-16.5% while Co 86032 recorded 17.7%. Single cane weight ranged from 0.2-1.4 Kg with a mean of

0.77 Kg. Four hybrids derived from typical *S.officinarum* clones with 2n=80 had sucrose of above 15.0% and these clones were selected for further evaluation.

Cytological studies in 20 hybrids indicated 2n= 85-142. A seedling hybrid from the GC of IJ 76-314 TC-3 had 2n+n /n+2n chromosome transmission. The hybrid AS 04-635 of CoH 114 x SH 216 (2n=72) showed better performance in ratoon crop under drought conditions in AICRP trials, morphological, physiological parameters and gene expression studies were carried out in pot culture experiments. Chlorophyll content and chlorophyll fluorescence was observed to be higher in the drought treated plants when compared to their controls. Several micro RNAs that are implicated in drought tolerance like mir156, mir166, mir167, mir393, mir396, mir397 and mir408 were observed to be differentially expressed in the leaves of plants under drought treatment.



'2n' transmission in the backcrossed hybrid with IJ 76-314 TC-3 GC (2n=142)

(A. Suganya, A. Selvi, P. Govindaraj and V. Sreenivasa)

Targeted pre-breeding with different cytotypes of *Saccharum spontaneum* L. characterized for abiotic stress tolerance

Evaluation of inter-specific clones derived between S. spontaneum and commercial canes: Modern sugarcane cultivars are genetically vulnerable having a narrow genetic base derived from a limited number of interspecific hybrids of *S. spontaneum* (as female parent) and commercial canes. Hybrid clones were developed using cytoplasm of *S. spontaneum* and commercial clones as pollen parents. These clones were evaluated for stalk characters and disease resistance. Results indicated moderate to high variability for all the characters. The clones of *S. spontaneum* were used as pistil parents and commercial clones with high sucrose content were used as pollen parents. In the first experiment, 300 progenies were evaluated for red rot resistance. Six clones derived from different cytotypes were resistant *viz*., IND 03-1256 [2n= 88] x CoV 92102 (SS 61, SS 64, SS 42), SES 106A (2n=64) x Co 0331 (SS 209, SS 230), IND 01-1142 (2n=72) x Co 1148 (SS 322), three moderately resistant, two moderately susceptible, ten susceptible and twenty-three highly susceptible. Based on the cane thickness, cane height, vigour and resistance, sixty clones were selected and planted for further backcrossing with high sucrose parents.

The second experiment conducted with 2500 seedlings derived from crosses effected in 2021 were evaluated for plant height, number of nodes, single cane weight, leaf length, leaf width, sheath length, internode length, stalk length, stalk diameter and number of leaves at 12 months. 197 genuine hybrid clones were selected based on morphological traits. Descriptive statistics of 13 traits revealed distinct variation for all the traits studied. The average plant height of the F1 hybrids was 414.79 cm. Plant height among the hybrids ranged from 340 cm to 510 cm. The clone SS 335 derived from the cross IND 04-1374 x Co 11015 recorded the highest plant height. Internode length varied from 10.17 cm to 19.33 cm with a mean value of 13.83. The clone SS 339 derived from the cross IND 03-1278 x Co 11015 recorded maximum internode length. The NMC ranged between 7 (Clone SS 262) from the cross Iritty 3 x Co 12009 and120 (clone SS 59) from the cross *S. spontaneum x* Co11015. The HR brix ranged from 11 % to 22%. The clone SS 291 derived from the cross IND 11-1664 X Co 11015 recorded the minimum and clone 486 (IND 19-2018 x Co 12009) recorded maximum H.R. brix value. A total of twenty backcrosses were made utilizing eight F_1 male parents developed from crosses made in 2020 and 2021. Somatic chromosome number has been determined in seven F_1 hybrids developed during 2021 crossing season.

Cytological studies to determine somatic chromosome number in F1 hybrids

S.No.	F1 hybrid	Parentage	2n
1	2021-497	IND 02-1209 (2n=60) x Co 11015 (2n=110)	85
2	2021-495	IND 02-1209 (2n=60) x Co 11015 (2n=110	84
3	2021-503	IND 02-1209 (2n=60) x Co 11015 (2n=110	84
4	2021-498	IND 02-1209 (2n=60) x Co 11015 (2n=110	84
5	2021-491	IND 19-2018 (2n=64) x Co 12009 (2n=110)	84
6	2021-494	IND 19-2018 (2n=64) x Co 12009 (2n=110)	84
7	2021-458	IND 03-1292 (2n=64) x Co 11015 (2n= 110)	88

(S. Sheelamary, S. Karthigeyan and V.P. Sobhakumari)

Identification of multi-ratooning potential of selected interspecific and intergeneric hybrids of *Saccharum* spp.

Forty-two clones comprising of ISH and IGH hybrids involving *S. officinarum*, *S. spontaneum*, *S. robustum*, *S barberi/sinense*, IGH/CYM and PIO/PIR clones with seven clones in each group were evaluated for their multi-ratooning potential with three standards *viz*., Co 86032, CoC 671 and Co 14016. The ISH and IGH hybrids were planted as single bud settlings during April 2021 as first plant crop in 4 rows of 6m length and 1.2m spacing between the rows. After the harvest of first ratoon crop during April 2023, the crop was ratooned to raise second ratoon crop during the year 2023-24 without gap filling. Forty-two clones along with standards were evaluated for tillering, cane yield and quality traits in second ratoon crop. Among the different groups, the hybrids derived from *S. spontaneum* had the highest stalk number with 185.43 ('000/ha) followed by CYM/IGH clones with 155.30 ('000/ha) and *S. barberi/sinense* group (152.87 '000/ha) as compared to commercial clones (93.78 '000/ha). The hybrids from CYM/IGH group recorded the highest mean cane yield (171.11t/ha) at harvest followed by *S. spontaneum* group (155.17 t/ha) and *S. robustum* group (149.11t/ha) in comparison with the standard Co 86032. The highest sucrose % at harvest was found in the clones from PIO/PIR group (19.25 %) followed by *S. robustum* clones (18.50%) and CYM/IGH involved group (18.49 %) as compared to the commercial clones (19.98%).

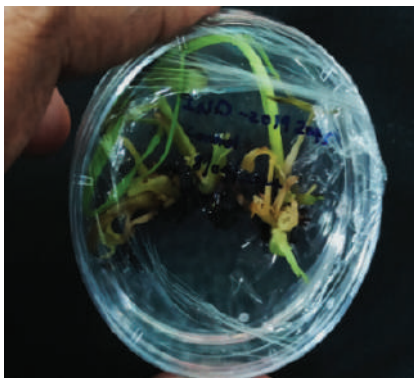
(K. Elayaraja and R. Gomathi)

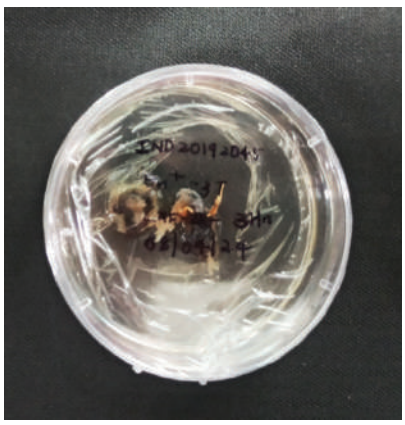
Cryopreservation of sugarcane genetic resources for long term storage and future utilization

Under long term conservation, different methods were tried for cryopreservation. Meristem derived axillary buds were found to be most suitable for cryopreservation. Studies were initiated to assess the survival of eight *S. spontaneum* clones conserved in liquid nitrogen for 15 to a maximum of 235 days. Similarly, three sugarcane varieties were stored for a maximum period of 317 days. Although, the clones were viable under long term storage but exhibited very slow regeneration ability.

Anatomy of cryopreserved cells

Cryopreserved cells were studied under light microscope to observe the changes in cell structure of cryopreserved clones. Light microscopy was used to describe the microstructure of cryopreserved and non-cryopreserved samples. The meristem-derived axillary buds of *S. spontaneum* clones (IND 2019-2045 and IND 2019-2035) and sugarcane cultivar (Co 11015) were sectioned at different time intervals *viz*., 3,7,14, and 21 days after Liquid Nitrogen (LN) treatment and post-thaw procedures to infer the changes in cellular structures of cryopreserved samples. The cross sections of meristem-derived axillary buds taken at different treatment levels and post-thaw durations exhibited damage to the epidermal and hypodermal regions. Vascular bundles were highly disorganized and collapsed. The ultra-low temperature freezing might have contributed to the ice nucleation within the cells which led to the destruction of cellular integrity.





MDAB in solid recovery media
(Top - control, Bottom - LN treated)

(C. Jayabose, R. Valarmathi and D. Neelamathi)

Development of Core Collection of Wild Sugarcane (*Saccharum spontaneum*) Germplasm

1624 accessions were characterized for eleven quantitative traits associated with cane and leaf morphology. The core set was developed using Corehunter 3.0 R package with stepwise approach and validated using *Evaluatecore* R package. Approximately, 10% accession was randomly selected to form a core set of 162 accessions. Univariate statistics such as mean using Student–Newman–Keuls (SNK) method and variance using Levene's test, mean difference (MD %), variance difference (VD %) and the significance of the Anderson-Darling distance (AD) were also used to validate the representativeness of core sets. Differences between means of the entire collection (EC) and core set (CS) were found significant only for leaf width and stalk height. The variances of the EC and CS were homogeneous for all the traits except leaf width (p=0.004) and stalk height (p=0.0005). The percentage of significant difference means (MD) recorded 18.18 % indicated that there is no difference in the mean values of EC & CS which is considered to be the efficient core set. This core set included a functional collection of *S. spontaneum* germplasm. Morphological and molecular analysis was done in 2021 collections. Forty-six sugarcane accessions were classified into five clusters. Among the five clusters, cluster I had the maximum of fifteen accessions (IND-2021-2066, IND-2021-2062, IND-2021-2063, IND-2021-2060, IND-2021-2057, IND-2021-2069, IND-2021-2059, IND-2021-2076, IND-2021-2075, IND-2021-2074, IND-2021-2073, IND-2021-2070, IND-2021-2064, IND-2021-2065, IND-2021-2070). Second cluster had five accessions (IND-2021-2082, IND-2021-2055, IND-2021-2056, IND-2021-2058 and IND-2021-2068). Cluster III had three accessions (IND-2021-2077, IND-2021-2072, IND-2021-2067). Cluster four and five consists of eleven clones in each of the clusters.

(S. Sheelamary, S. Karthigeyan, C. Jayabose and M. Nisha)

Population improvement and development of sugarcane genetic stocks for high sugar accumulation potential for sub- tropical India

Among the sugarcane genotypes evaluated in different clonal stages, four genotypes recorded >20% juice sucrose. In C2 stage, out of 104 clones evaluated, two clones registered more than 21% mean sucrose, while six clones had more than 20% sucrose. Crosses involving the clones *viz*., Laukona, Chapina, Green German, SO Hybrid, Koeng, CP 52-1 and PIO clones were attempted during 2023-24. During 2024 crossing season, seven bi-parental crosses were carried out at ICAR-SBI RC, Agali. Sixteen biparental crosses and six selfs were made at National Hybridization Garden, Coimbatore

(A. Anna Durai and R.T. Maruthi - ICAR-SBI; M. Swapna, Sanjeev Kumar (Plant Breeding) and Sanjeev Kumar (Agri. Biotechnology) - ICAR-IISR, Lucknow)

Molecular cytogenetic and agronomic characterization of introgressed lines of *Erianthus x Saccharum*

Genomic DNA has been isolated from IND 90-776 (*Erianthus procerus*). Fragmented DNA labelled with biotin is used as probe for *in situ* hybridization. GISH analysis was done in the following BC_2 clones of *Erianthus procerus* x *Saccharum officinarum*. Somatic chromosome number of these clones were also determined through root tip mitosis. The hybridity of these clones has been confirmed by amplification of *Erianthus* specific tandem repeat (ESTR) marker also. Among these two clones, GU 19-193 and GU 19-334, showed 2n+n chromosome segregation

Root-tip mitotic studies to determine somatic chromosome number in BC_2 clones

Back crossed progeny number	BC_2 clones	Parentage	2n	*Erianthus chromosomes in GISH analysis
BC2 9	GU19-57	GU12-33 X Co 11015	102	9E*
BC2 12	GU19-82	GU12-33 X Co 11015	98	-
BC2 16	GU19-130	GU12-24 X Co 16018	102	9E
BC2 20	GU19-193	GU12-37 X Co 0209	114	17E (2n+n)
BC2 20-3	GU19-322	GU12-34 X Co 09010	134	8E
BC2 36	GU19-334	GU12-37 X Co 0209	116	17E (2n+n)
BC2 45	GU19-397	GU12-33 X Co 012014	84	10E
BC2 46	GU19-417	GU12-24 X Co 16018	82	9E
BC2 61	GU19-506	GU12-33 X Co 12014	82	10E
BC2 84	GU19-543	GU12-51 X Co 12009	90	-

Agronomic characterization of BC_2 clones between *Erianthus procerus x Saccharum officinarum:*

The BC_2 progenies involving *Erianthus procerus* were evaluated for juice and cane yield. The single cane weight ranged from 1.18 kg in GU 19-82 to 1.78 kg in GU 19-417. The clone GU19-334 recorded the highest sucrose of 20.27% followed by GU 19-57 (18.51%). The clones were screened for red rot resistance using cf 671 inoculum. Out of ten clones, six were resistant to red rot and only one was susceptible.

Characterization of BC_2 clones (*E. procerus x S. officinarum*) for cane yield and juice traits

BC2 Clone	C. Ht (cm)	C. Dia (cm)	S C Wt (kg)	Brix %	Pol %	Purity %	Red rot Resistance
GU19-57	252.50	2.55	1.35	21.14	18.51	87.48	MS
GU19-82	235.00	2.66	1.18	17.65	14.68	83.15	S
GU19-130	250.00	2.71	1.34	19.14	16.45	85.97	MR
GU19-193	195.00	2.88	1.23	16.06	11.71	72.69	MR
GU19-322	242.50	3.05	1.74	18.64	15.93	85.39	MR
GU19-334 (17E)	260.00	2.99	1.68	22.48	20.27	90.19	MS
GU19-397	257.50	2.63	1.24	17.46	14.71	84.24	MR
GU19-417 (17E)	262.50	2.94	1.78	17.36	14.91	85.86	MR
GU19-506	267.50	2.77	1.68	18.75	15.57	83.00	MR
GU19-543	232.50	3.08	1.76	16.72	13.69	81.63	MS

Evaluation of backcross hybris involving *E. arundinaceus* for cane yield, juice quality traits, Stress tolerance Index (STI) and red rot resistance

The agronomic performance of the backcross hybrids involving *Erianthus arundinaceus* for cane yield, quality and red rot resistance is presented in the Table. Eight hybrids recorded significantly higher cane height than the commercial hybrid Co 86032 (225 cm). The sucrose in juice at 300 days ranged from 8.44% (TWC 82) to 19.98% (Co 15015). Three hybrids recorded significantly higher yield than the commercial check Co 86032 (121.8 t/ha).

Performance of back cross hybrids derived from *E. arundinaceus* for cane yield and juice traits

	Clone Name	Cane Ht (cm)	Cane dia (cm)	SCW (Kgs)	Brix (%)	Pol (%)	Purity (%)	CCS %	NMC ('000/ ha)	Cane yield (t/ha)
BC1(24E)	CYM 07-971	210.00	2.61	1.09	14.72	12.06	81.93	8.03	89.00	96.71
BC2(12E)	CYM 08-903	205.00	2.91	1.20	19.07	16.94	88.83	11.74	75.00	89.75
BC2(12E)	CYM 08-922	255.00	2.75	1.38	14.89	12.09	81.20	8.01	101.50	140.07
BC3(4E)	Co 15015	240.00	2.80	1.25	21.63	19.98	92.37	14.10	88.10	110.13
BC3(7E)	TWC 82	265.00	2.95	1.68	11.88	8.44	71.04	5.16	98.30	165.14
BC4	GI 18-1	220.00	2.46	0.82	19.67	17.60	89.48	12.24	85.00	69.98
BC4(2E)	GI 18-2	235.00	2.57	1.15	15.61	13.17	84.37	8.90	89.00	102.35
BC4	GI 18-3	235.00	2.71	1.22	19.41	17.11	88.15	11.82	91.50	111.63
BC4(4E)	FWC-28	275.00	2.67	1.15	16.19	13.66	84.37	9.23	94.44	108.61
BC4(3E)	FWC-29	205.00	2.83	1.23	15.47	13.28	85.84	9.05	86.11	105.92
BC4(5E)	FWC-39	255.00	2.51	1.25	15.85	13.48	85.05	9.15	60.19	75.23
BC4(4E)	FWC-2	235.00	2.65	1.45	13.51	10.51	77.79	6.80	100.00	145.00
	Standard									
	Co 86032	225.00	2.75	1.45	19.91	17.79	89.35	12.37	84.00	121.80
	CD (P>0.05)	16.23	0.32	0.18	1.12	1.05	4.56	0.98	9.56	11.36

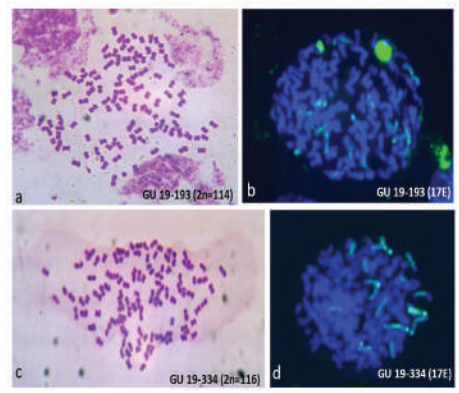
The clones were also screened for water stress. The results showed that the commercial check (Co 86032) recorded a stress tolerance index of 0.761 and three clones (CYM 08-922, TWC 82 and FWC-2) recorded significantly higher STI. The hybrid TWC 82 recorded the highest STI of 1.678 followed by FWC-2. The entry TWC 82 combined both red rot resistance and water stress tolerance. For red rot resistance, eight were moderately resistant and only one was susceptible.

Stress tolerance Index (STI) of backcross hybrids involving *E. arundinaceus* x *Saccharum*

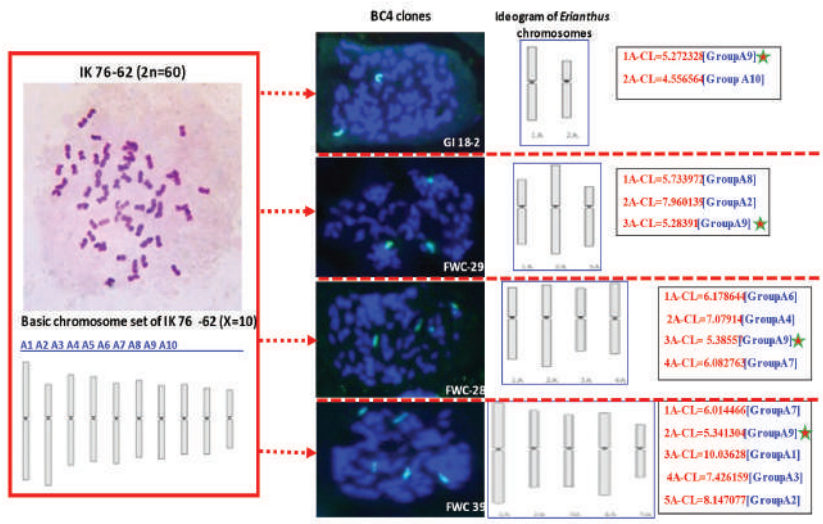
Back cross generation	Clone	Cane yield (t/ha)		STI	Red rot Resistance
		Control	Stress		
BC_1(24E)	CYM 07-971	96.71	72.3	0.558	MR
BC_2(12E)	CYM 08-903	89.75	68.5	0.490	MR
BC_2(12E)	CYM 08-922	140.07	115.5	1.290	MR
BC_3(4E)	Co 15015	110.13	75.34	0.662	MR
BC_3(7E)	TWC 82	165.14	127.35	1.678	MR
BC_4	GI 18-1	69.98	52.2	0.291	MR
BC_4(4E)	FWC-28	108.61	82.3	0.713	MS
BC_4(3E)	FWC-29	105.92	78.3	0.662	MR
BC_4(5E)	FWC-39	75.23	48.75	0.293	MR
BC_4(4E)	FWC-2	145.00	117.35	1.357	S
	Co 86032	121.80	78.35	0.761	MS
	Overall mean	111.97	80.67	0.771	
	Treatments (P>0.05)	9.85			
	Clones (P>0.05)	16.34		0.34	

Karyotyping of *Erianthus* parental clone and BC_4 progenies of *Erianthus x Saccharum*

A semiautomated karyotyping software, 'KaryoMeasure" has been used for karyotyping of IK 76-62 and four BC_4 progenies of IK 76-62 x *Saccharum*. After identifying the basic set of chromosomes for these clones a comparative karyotype analysis has been done between parental clone (IK 76-62) and BC4 progenies. It was found that none of these BC_4 progenies are having homologous pair of *Erianthus* chromosomes. It is observed that in all BC_4 progenies one *Erianthus* chromosome from 9th group of basic set was present.



Cytological studies in BC_4 progenies of Erianthus x Saccharum



Comparative karyotype analysis between IK 76-62 and its BC_4 progenies

(V.P. Sobhakumari and K. Mohanraj)

Sugarcane genomics and molecular markers

Isolation and characterization of genes associated with high Water Use Efficiency (WUE) in sugarcane cultivars

Twenty primers were designed to amplify the full and partial gene sequences of WIN1, CER1, EPFL1 to EPFL10, SDD1, ERECTA and TMM genes. Twenty sugarcane genotypes that include three high and low water use efficiency clones Co 85019, Co 12009, Co 10026 and Co 86032, Co 62175, CoM 0265 respectively, were evaluated for 4 years to study the WIN1 (Wax INducible) genes. The WIN1 ethylene transcription factor is involved in activating the wax deposition genes such as CER1, CER2 and KCS1 in overexpressing plants. About ten primers were designed to amplify the various regions of WIN1 that are 1.8 to 4 kb long. Out of these ten primers, one primer pair consistently amplified a 1.8 Kb thick fragment in all the samples. The sequencing results of all the six fragments of 1.8 Kb length showed a high similarity (96%) with the WIN1 transcription factor of the sugarcane monoploid genome of R570 genome and exhibited similiarity with other WIN1 genes of major plant genomes in NCBI blast. The PCR fragments of the six sugarcane genotypes were cloned in pJET cloning vector and the cloned vector samples were sequenced to obtain the full length reads. These sequences showed more than 96% similarity with the WIN1 transcription factor of sugarcane as well as other monoploids such as Maize, Sorghum, *Setaria* and *Triticum*.

Primers designed to amplify the gene sequences of CER1, EPFL1 to EPFL10, SDD1, ERECTA and TMM genes showed non-specific amplification. The sequences of the thickly amplified bands didn't match with the corresponding gene sequences in the database. Total

RNA was isolated from the young shoots and cDNA library construction was done. The primers for GTL 1A, SLAC 100 and AN3 gene were tested, but no amplification was observed.

(K. Devakumar and P.T. Prathima)

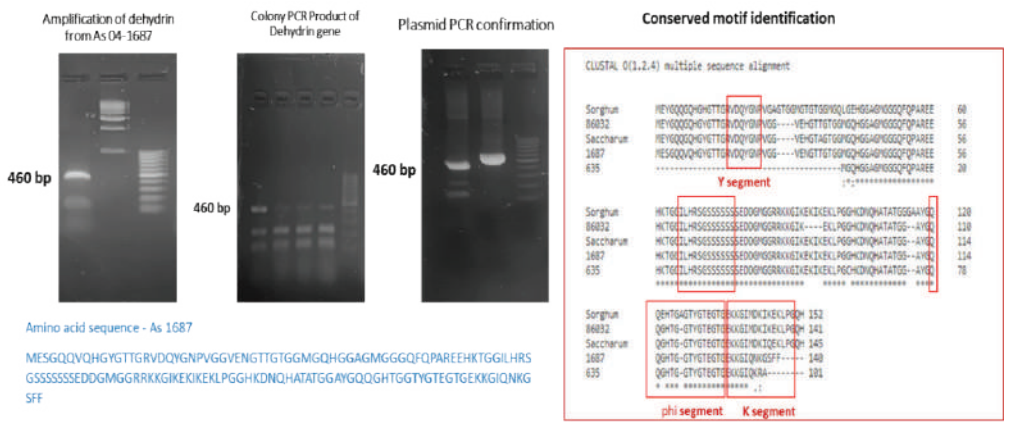
Identification of functionally relevant SSRs and SNPs from drought and oxidative stress responsive transcriptomes of sugarcane and functional validation of key genes for stress tolerance

Differential expression of drought candidates in ISH and Co cultivars: Four interspecific hybrids and two sugarcane varieties were chosen for drought screening. After 6 days of stress, the leaves of the susceptible genotype (Co 8021) indicated evident signs of stress like mild wilting, yellowing and continuing to whole leaf rolling and necrosis at severe drought condition. On rehydration highly tolerant clones like AS-04-1687 and As-04-635 and recovered rapidly compared to tolerant clone Co 06022 and slow recovery observed in As-04-2097, As-04-245 and cultivar Co8021. Gene expression analysis with twenty drought candidates like Dehydrin, DREB, NAC domain containing gene (NAC086), Glutathione S transferase, Calmodulin Binding factor, Cellulose synthase *etc* revealed that the clone AS-04-1687 and As-04-635 are most tolerant clones among interspecific clones and AS-04-245 is the least tolerant clone.

Cloning of Dehydrin Gene: Conserved domain of the Dehydrin genes was identified from transcriptome data and primers was designed. Cloning was performed from drought treated samples of AS-04-1687 using D forward primer 5'-ATGGAGTACGGTCAGCAG-3 and D reverse primer 5'-TTAGTGCTGTCCGGGCAG-3'. The conserved region of the Dehydin gene around 460 bp was cloned and sequenced. The cloned Dehydrin gene revealed high similarity with Saccharum hybrid cultivar PSJT 941 dehydrin (DHN1) mRNA, complete cds. The presence of an ORF that codes for 141 amino acids with conserved motifs such as, the K-segment, a lysine rich sequence near the C terminus, a Y-segment, a tyrosine rich sequence and a S-segment a serine rich sequence, both near the N terminal was observed. Prosite analysis of dehydrin compared with *Sorghum* & *Zea mays* and other *Sacharum* cultivars revealed that the isolated sequence is unique with respect to domain distribution and domain position in the protein sequences.

Binary Vector construction and Plant transformation: In order to facilitate directional cloning into the binary vector pCAMBIA 1305.1 (11847bp), the Dehydrin gene of interspecific clone AS-04-1687 (460bp), cloned in the plasmid vector pJET1.2, was amplified using gene-specific primers designed to include the recognition sequences of BamH I and Hind III in the forward and reverse primers. The Dehydrin gene after restriction with the above enzymes was ligated into the binary vector pCAMBIA 1305.1 and gene construct, pCAMBIA 1305.1: Dehydrin was cloned into DH5 α. Plates with kanamycin antibiotics were used to select the transformants.

Cloning of Trehalose Phosphate Synthase (TPS) and Cytochrome P450: The drought tolerant sample of Co 06022 was used for cloning the conserved regions of TPS and Cytochrome P450 gene. Partial gene sequences retrieved from the transcriptome data was used for primer designing. Amplification of the cDNA using gene specific primers resulted in an amplicon size of 1.1kb and 1.5kb. The amplified fragments were cloned into pJET1.2 cloning vector. The cloned fragments were sequenced and a map was generated.

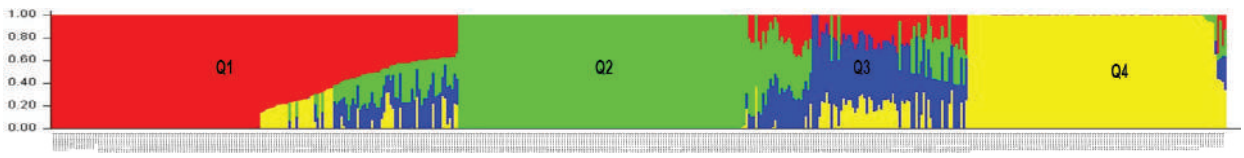


Cloning and characterisation of drought candidate gene dehydrin from AS 04-1687

(A. Selvi, R. Manimekalai, P.T. Prathima, K. Lakshmi and K. Devakumar)

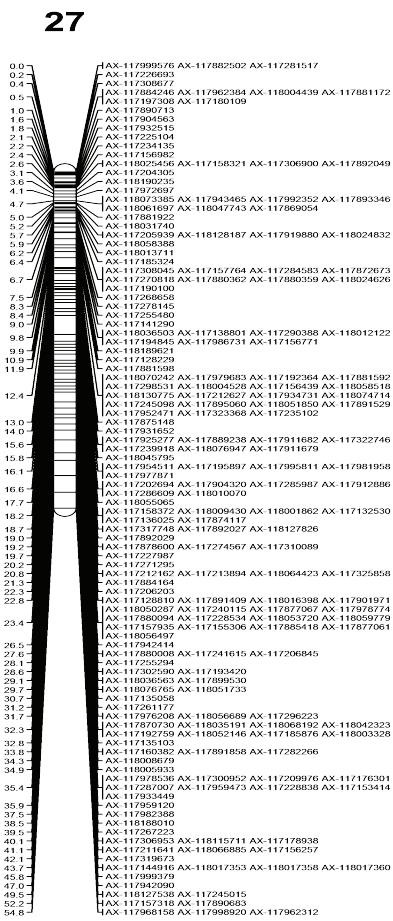
Development of affordable genomic selection tools for sucrose content and genomic prediction models for yield in sugarcane

The genetic diversity and trait relationships of 499 sugarcane genotypes were analyzed using the Axiom Sugarcane 100K SNP array. The dataset included 15,011 SNP markers representing five different populations (BO 91 x Co 775, Co 1148 x Co 775, Co 86002 x BO 91, CoM 0265 x Co775 and Co Canes). Population structure analysis was done based on Bayesian clustering for K = 4. The agronomic traits partitioned into four colours (red, green, blue, and yellow), corresponding to the proportion of genetic membership in subpopulations Q1, Q2, Q3, and Q4, respectively. This clustering pattern showed the genetic differentiation and admixture among the mapping population.



Structure of populations used for the GWAS analysis

Genetic linkage maps were constructed from two biparental populations of Co 775 (194 progenies) and BO 91 (215 progenies) with 2718 and 2158 single dose markers respectively. The BO 91 population showed 194 linkage groups (LGs) giving a total map length of 5636 cM and an average distance of 2.8 cM between markers. The combined population for Co 775 generated 116 LGs and a map distance of 4494.5 cM and an average distance of 1.7 cM between markers



Representative linkage group of sugarcane

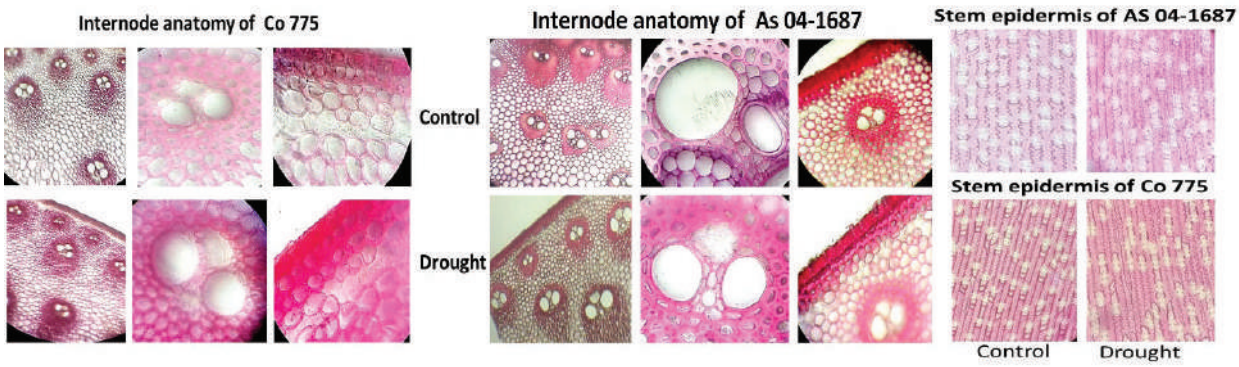
(R. Manimekalai, G. Hemaprabha, A. Ramesh Sundar, K. Mohanraj and P.T. Prathima)

Deep sequencing of suppression subtractive libraries for prospecting differentially expressed genes/Transcription factors from the sugarcane hybrids exposed to drought and salinity stress.

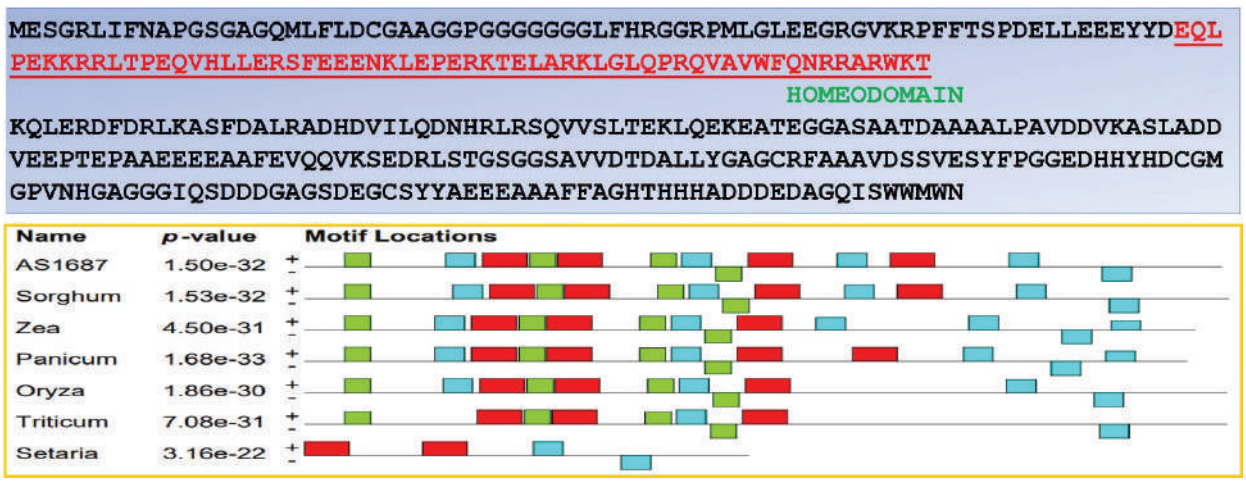
Biochemical responses of sugarcane varieties under salinity

Nitrate reductase (NR): NR activity of Co 94012, Co 85019 and Co 775 under control were 86.16, 88.02, 79.15 µmol NO_2 g^{-1} Fresh weight respectively. Co 85019 expressed its tolerant nature with high NR activity of 68.24 µmol NO_2 g^{-1} FW at 8 dSm^{-1} and lesser reduction of 15.12% and 22.47% decrease in 6 and 8 dSm^{-1} respectively.

Proline: Proline content ranged from 17.15 to 42.54 µmol g^{-1} FW over different saline treatments, whereas under control treatment it was 8.30 to 14.13 µmol g^{-1} FW. Genotype Co 85019 which showed largest effective tolerance for all above studied physiological parameters.



Anatomy of internode and leaf of drought tolerant AS 04-1687 and the drought sensitive clone Co 775



Amino acid sequence and the motif identified for the homeodomain leucine zipper (HDLZ) isolated from the sugarcane interspecific hybrid AS-04-1687

ipid peroxidation (LPO): LPO showed increasing trend of Malondialdehyde (MDA) accumulation with increasing salinity. LPO ranged from 0.88 to 1.48 MDA nmol g^{-1} FW at different saline treatments. Genotype Co 85019 registered the lowest LPO of 0.88 and 1.03 at 6 and 8 dSm^{-1} respectively.

Anatomical studies: The anatomical studies in the drought tolerant AS 04-1687 and the drought sensitive clone Co 775 exhibited the typical grass anatomy. The leaf anatomical changes with increase in cuticle thickness, bulliform cell size, vascular bundle, silical cells and stomatal density and decrease in stomatal size indicated their adaptive features. AS 04-1687 exhibited more adaptive features than the sensitive clone Co 775.

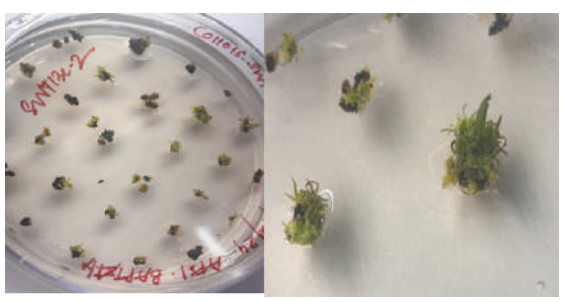
Cloning of Homeo Domain Leucine Zipper: Based on the physiological analysis, clone AS-04-1687 was chosen for drought induced transcription factor identification. Genomic DNA was isolated from AS-04-1687 and used as template for the amplification of Homeo domain leucine Zipper (HDLZ) transcription factor. We were

able to get an amplification ~3.0 kb which was cloned using blunt end cloning strategy into pJET vector. Total RNA was isolated from drought treated AS-04-1687, converted into cDNA, normalised using 25s rRNA and used as template for the amplification of the coding sequence of HDLZ. We were able to observe an amplicon size of 1.3 kb, which was cloned and submitted for sequencing. The homeodomain leucine zipper (HDLZ) is a transcription factors which belongs to homeobox (HB) protein superfamily. Members of the HDLZ-1 family have a homeodomain (HD) at the N-terminal that functions as a DNA-binding site and a leucine zipper motif (LZ) immediately downstream of the HD that acts as a dimerization motif. Hence the identified and cloned HDLZ-1 might function as a transcriptional regulator that can positively regulate drought tolerance through an ABA-dependent signalling pathway.

(K. Lakshmi, A. Selvi, R. Gomathi, A. Suganya, K. Devakumar, S. Sheelamary and Pooja)

Genome wide identification, characterization and comparative genome analyses of SWEET genes regulating sucrose accumulation in sugarcane

CRISPR-Cas mediated functional gene validation of SWEETs in sugarcane: Candidate genes, including SWEET4a, SWEET3a, and SWEET13c, were selected for gene editing *via* the CRISPOR-Cas9 system. Guide RNAs specific to these genes were designed using the CRISPR tool, subsequently synthesized and cloned into the pRGEB31 plasmid for gene editing purposes. The constructed plasmids were then transformed into *Agrobacterium tumefaciens* strain LBA4404. The embryogenic calli, following infection with the transformed *Agrobacterium*, were cultured on hygromycin-containing selective media to isolate putative gene-edited calli, which were then transferred to regeneration media for subsequent shooting and rooting of the transgenic plants

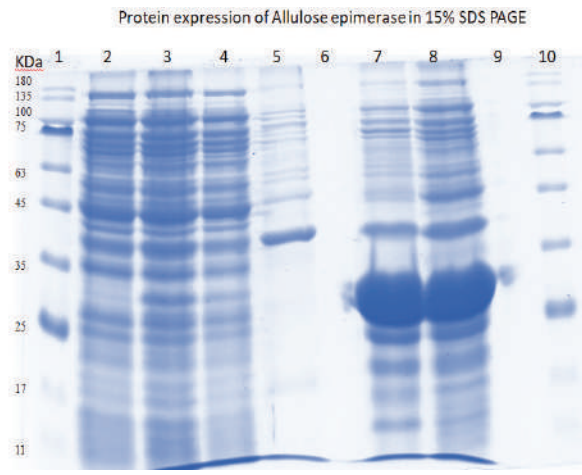


Putative transformed calli on fourth selection and regeneration media

(P.T. Prathima, A. Selvi, R. Manimekalai, K. Lakshmi and K. Thamilarasi)

Metabolic engineering of sugarcane for enhanced accumulation of low-calorie sugars through gene editing

Characterization of D-Allulose epimerase gene: The recombinant plasmid, after confirmation of the presence of insert, named as pET28a: ALSEase was transformed into *E. coli* BL21 (DE3) cells. The overexpression of ALSEase was induced at different conditions, such as temperature 37°C, 30°C, 20°C, and 25°C, time period 3 hours and overnight, by adding isopropyl β-d-1-thiogalactopyranoside (IPTG) of 1 mM and 0.2 mM and kept at 180 rpm, when the light absorption values of the cultured cell mixture at 600 nm reached 0.6–0.8. As a negative control, the non-induced treatment was cultured in the previously specified conditions without the addition of IPTG. It was found that the overexpression of protein from pET28a-Bs2-22 ALSEase after IPTG resulted in inclusion bodies. The retained protein was trapped on Ni-NTA super flow resin for *His* tagged protein purification. The protein purity was determined SDS-PAGE analysis as well as the determination of protein concentration was done by the Lowry's estimation method using bovine serum albumin as standard. The purified protein was stored at 4°C for further experiments.



Total proteins from bacterial lysate showing expression of ALSEase (7th and 8th lanes; Size 25 KDa) on 15% SDS-PAGE gel

(P.T. Prathima, K. Lakshmi, A. Selvi, R. Manimekalai, and V. Krishnapriya)

Identification and functional characterization of GRAS transcription factor family of genes and its response to various abiotic stresses in sugarcane.

Tolerant and susceptible sugarcane clones for abiotic stresses *viz*., drought, salinity, flooding and cold (Salinity

tolerant: Co 94012, Co 94008, Co 85019, Co 99004, Co 95003, Co 97001, Co 97008; Salinity Susceptible: Co 97010, 95007; Drought tolerant: Co 06022, Co 99004, CoM 0265, Co 85019, Co 98017, Co 740; Drought susceptible: Co 775, Co 8021, Co 419, Co 8368; Flooding tolerant: Co 90006, 14005; Cold Tolerant: Co 06035, Co 12026, Co 12027, Co 0237, Co 0327, Co 0331, Co 06033; Cold Susceptible: Co 0240, Co 0241, Co 05010, Co 06032, Co 06034, Co 06036, Co 06037, Co 07022, Co 07023, Co 07024) were raised in pots for this study. Five primers were designed to amplify the GRAS 28 transcription factor gene from the genomic DNA of these sugarcane clones. The amplified DNA band was sequenced and showed high similarity to GRAS transcription factor of R570 genome. The Isolation of RNA from leaves, culm and root is also standardized and cDNA prepared.

(K. Devakumar and K. Lakshmi)

A proteomic approach for identification and characterization of new ligninolytic enzymes for improved sugarcane bagasse delignification

Proteins obtained from different isolates identified for laccase enzyme production were quantified using Bradford Protein Assay. The estimated concentration of the protein for S1, S3, S6 and S10 were 34.23, 32.66, 30.74 and 30.33 ug/5ul respectively. These samples were processed for 2D Proteomic analysis. Thirty-nine spots were identified by comparing S1 and S3 isolates. The spots 18, 33, 17, 2 and 35 showed an expression value of 16.81, 8.27, 8.26, 5.34 and 4.95. While the comparison between S6 and S10 isolates enabled the identification of 47 spots. The spots 17, 22, 36, 41 and 44 showed an expression value of 9.02, 8.84, 8.13, 6.57 and 5.81. Among the spots identified, 25 spots for (S1 vs S3) and 22 spots for (S6 vs S10) were picked and submitted for MALDI-TOF analysis. The enzymes identified were extracellular xylanases of 26.3 and 27 kDa (xyl I); 7.7 and 17.7 kDa (xyl II), hemicellulases, and pectinases. Few cellulases and glucan endo-1,3-β-glucosidase were also observed in the isolate of S1-treated samples.

Proteins identified from 2D-gel spots

Spot ID	Isolate S1	Isolate S3	Description	Accession No	MW (Kda)	pI	Score
18	1	16.8088	Cellobiohydrolase II	B2ZZ24	47.2	5.3	20.6
33	1	8.26755	Endoglucanase	Q5W7K4	42.2	4.9	15.4
17	1	8.25808	Acetyl xylan esterase	PC H2ESB9	38.9	6.5	12.9
2	1	5.34369	Uncharacterised				
35	1	4.95048	Endoglucanase	Q5W7K4	42.2	4.9	63.1
27	1	4.31365	Versatile peroxidase 2 (VP2)	G8FPZ2	38.5	4.7	629.7
8	1	3.78213	Putative protein	D2JY75	27.8	6.6	162.8
29	1	3.71756	Uncharacterised				
14	1	3.63374	Peptidyl-Lys metalloendopeptidase	P81055	17.9	6.2	118.5
34	1	3.59765	Ribonuclease	Q75NB1	41.5	6.4	65.1
32	1	3.45855	α-L-arabinofuranosidase	G0TES6	68.9	8.1	52.2
12	1	2.12476	Uncharacterised				
3	1	2.10072	Putative aspartyl-proteinase (fragment)	Q96TV7	18.5	6.2	51.8
5	1	1.95874	Cellulose 1,4-β-cellobiosidase	A5AA53	49.3	5.6	50.6
4	1	1.45523	Peptidase 1	C4PFY6	38.7	8.2	42.4
9	1	1.3721	Uncharacterized protein		22.397	6.31	55

(K. Lakshmi and P.T. Prathima)

Harnessing comparative genomics and bioinformatics tools for abiotic stress tolerance in sugarcane

Various genes, transcription factors (TFs) and other regulatory elements, including promoters, miRNAs and key molecular signalling pathways have been extensively reported for their role in regulating abiotic stress (drought, heat, salinity, cold, and water logging) susceptibility and resistance in both model and non-model plants, including sugarcane. The major transcription factors involved in abiotic stress tolerance in sugarcane include the WRKY, NAC, MYB, and AP2/ERF protein families. In other major crops, key transcription factors include WRKY, DREB, MYB, NAC, APETALA2, bZIP, and ERF protein families. Information regarding these genes, proteins, transcription factor and other data has been obtained through literature review with genomic data sourced from public domain databases such as NCBI, Oryzabase, PlantPReS, PlantTFDB, UniProt, and TAIR. For sugarcane whole genome, data was downloaded from Sugarcane Genome Hub (SGH) with the sequence of the modern sugarcane cultivar R570 being utilized in the study.

An alignment search was performed using the protein sequence of drought and salinity tolerance related genes from crops such as rice, sorghum, maize and Arabidopsis alongside the protein sequence of sugarcane cultivar. The alignment scores indicated a significant degree of similarity, ranging from 43% to 93%, with the highest similarity observed with sorghum genes. The PlantPReS database provides information on 79 genes involved in salinity tolerance, including those that are upregulated and downregulated under salinity stress conditions. In sugarcane, several candidate genes have been identified and reported for their involvement in abiotic stress, and these have been targeted through genome editing approaches, resulting in the development of multiple stress-resistant/tolerant transgenic cultivars.

(Shweta Kumari, R. Manimekalai, A. Selvi, K. Lakshmi and Vinayaka)

Gene discovery and genetic transformation in sugarcane

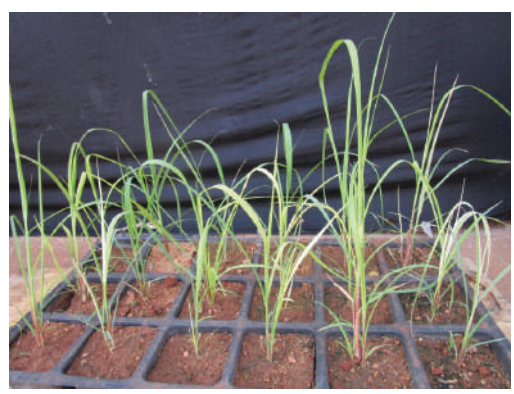
Isolation, cloning and characterization of novel stem specific promoter from *Erianthus arundinaceus*

The promoter isolated from *Erianthus* (EriPht) showed constitutive expression. To identify the core region of the EriPht promoter that control the expression pattern in different tissues and organs at various developmental stages, five deletions construct were generated. Among them, three deletion constructs D2, D3 and D5 were mobilised to E. coli DH5α. After transient GUS expression confirmation, these constructs were mobilised into *Agrobacterium* LBA4404 and confirmed by colony PCR, plasmid PCR and restriction digestion. The tobacco leaf discs infected with Agrobacterium having deletion constructs were co-cultured on plant transformation medium. The putative transformed leaf discs were transferred into selection medium containing hygromycin. After four rounds of selection, the callus was transferred to plant regeneration medium. The transformed plants were kept for hardening in glass house conditions and hardened plants were planted in pots for seed production. The seeds from T_1 were harvested from transgenic plants and were sown to get T_2 seedlings. The GUS assay of the T_2 plants showed that there are no differences in the expression of these deletion construct. This technology on "EaPHT promoter isolated from *Erianthus* (*Tripidium*) *arundinaceus*, capable of directing high level constitutive expression of a target nucleotide sequence of interest in a plant" is certified by ICAR (ICAR-CS-SBI-Technology-2024-009).

(C. Appunu and H.K. Mahadeva Swamy)

CRISPR/Cas9 mediated targeted mutagenesis in sugarcane

Phytoene Desaturase (PDS) gene was targeted to validate the genome editing in sugarcane variety Co 86032 through CRISPR/Cas9 mediated gene editing. Four sgRNA's were designed and cloned in pRGEB31 vector independently. Transformation was performed using these vectors. Transformed calli were selected on selection medium and subsequently after eight rounds of selection, calli were allowed for regeneration. More than 74 putative transgenic plants were hardened and observed for phenotypic variations. Mutant frequency was low. Sequence analysis confirmed the presence of deletions.



Targeted mutagenesis in PDS gene Saccharum hybrid Co 86032 using the CRISPR/Cas9 system

(C. Appunu and R. Valarmathi)

Deciphering the molecular mechanism regulating tillering in sugarcane through functional genomics approach

Tiller number is a key yield attributing trait in sugarcane, which decides the number of millable canes at harvest. The process of tillering (tiller bud initiation and outgrowth) is controlled by both genetic and environmental conditions. Deciphering the molecular mechanisms controlling the processes is critical to improve tillering ability in sugarcane. Intensive functional genomics was carried out among contrasting sugarcane intergeneric hybrids to understand tillering in sugarcane during the initial stages of tiller development.

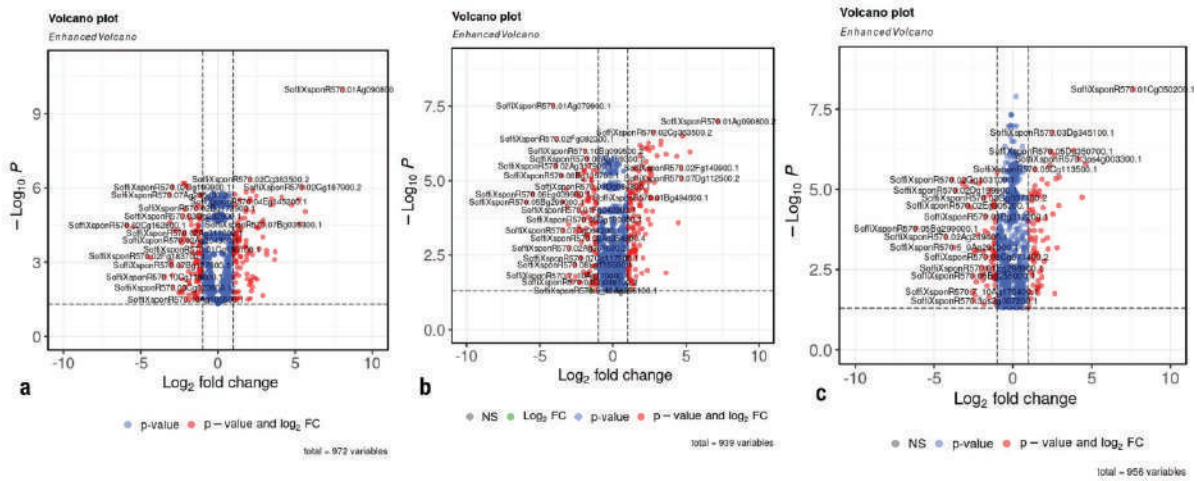
Phenotyping of the first tiller node at 20 to 40 days after planting (DAP) showed early meristem initiation and tiller outgrowth among the high tillering genotypes compared to the low and medium tillering genotypes. Quantitative proteomics analysis of the tiller node tissues from a high (Co 86032) and low tillering genotype (Co 99004) identified 2,867 significantly differentially abundant proteins ($-1 \leq Log_2 FC \geq 1, q \leq 0.05$). Significant pathways involved in photosynthesis, carbohydrate metabolism, C-type lectin receptor signalling and linoleic acid metabolism with higher abundance of proteins was observed in Co 86032.

Proteins specifically involved in sugar transport, nitrogen metabolism, cell wall organization, cytokinin signalling and kinases exhibited 4-fold higher abundance, while proteins for strigolactone, auxin, abscisic acid, and gibberellic acid, involved in the negative regulation of tillering, showed significant lower abundance in tiller nodes of Co 86032 compared to Co 99004. Gene expression validation of selected candidate proteins (*ShMAX4*, *ShMAX3*, *ShTB1*, *ShSWEET1A* and *auxin efflux carrier protein*) was found to be consistent with the differential protein abundance quantified among the high and tillering sugarcane genotypes.

Combined "-omics" (phenomics, proteomics, and transcriptomics) analyses of sugarcane genotypes contrasting in tillering ability in India as well as in Louisiana (USA) led to the identification of proteins and transcripts with potentially significant roles in controlling tillering. Protein and gene co-expression network modules identified promising candidate genes associated with tiller initiation and/or development.

This study provides clues to the genetic basis of tillering by identifying candidate genes involved in tiller initiation and development for targeted genetic improvement of sugarcane plant architecture and cane yield.

Phenotype showing the stages of tiller development among high (Co 86032) and low (Co 99004) tillering genotypes at 20, 30,40 days after planting (DAP)



The volcano plot shows differential protein abundance of proteins identified from the tiller nodes of Co 86032 compared to that of Co 99004 a) 20 DAP, b) 30 DAP, c) 40 DAP. Grey circles represent non-significant proteins, blue circles represent significant proteins at P-value ≤ 0.05 and red circles represent significant proteins with $log_2FC \geq 1$, $log_2FC \leq -1$ with P-value ≤ 0.05.

(R. Valarmathi, C. Appunu and K. Mohanraj)

Development of white grub resistant transgenics in sugarcane

Cry8Sa1, a novel cry toxin gene isolated from *Bacillus thuringiensis* was found to be a toxin against white grub species, *Holotrichia serrata*. In order to effectively manage white grub from sugarcane field infestation, Cry8Sa1 was codon optimized for better expression in sugarcane.

(C. Appunu, B. Singaravelu, G.S. Suresha and P. Mahesh)

Multi-disciplinary

Standardization of true seed production technique through developing homozygous parental lines and apomixes

Inbreeding

A total of forty-five selfs and twelve crosses were effected in 2024 flowering season involving progenies derived from seventh (S7) and eighth generation (S8) selfs of Co 1148. Six different populations of advanced generation inbreds of Co 1148 and Co 775 and first generation selfs of Co 11015 were raised in the ground nursery and DNA was isolated from all the genotypes to study the molecular profile. HR Brix recorded at twelve months ranged from 11% to 25.2%. Juice analysis conducted in three advanced generation inbred populations of Co 1148 at 12 months. Juice sucrose ranged from 13.88% to 22.48%. Two 8th generation inbreds from 1148-S4-252-24-350-16 and three 5th generation inbreds from 1148-13-11-2-252-170 recorded more than 20% juice sucrose content. Molecular analysis of these four genotypes revealed that the inbred from S8 generation (1148-S6-170-28) comparatively less heterozygous based on fewer amplified marker alleles and fixation index. Ninety-three selfs derived from three inbred parental clones were tested for red rot resistance. Evaluation of parent-progeny behaviour for red rot reaction indicated less segregation for the trait. For instance, 1148-13-11-2-252-170 (MR) produced the progeny which are more of R or MR than S or HS.

Segregation pattern of selfed progenies for their response to red rot

Parent		Progenies		
Selfed parents	Red rot reaction	Tested	Generation	Frequency for the disease
1148-13-11-2-242-1-40	R	26	S6	4(S): 4(MS): 9(MR): 9(R)
1148-s4-252-24-350-16	S	36	S8	22(S): 14(MS)
1148-13-11-2-252-170	MR	31	S5	14(MS): 11(MR): 6(R)

(G. Hemaprabha, V. Vinu, A. Anna Durai, T. Lakshmi Pathy and K. Chandran)

Evaluation of hybrids

Tropical (Coimbatore)

Assessing the extent of variability in the intermated inbred progenies: Seedling evaluation of five combinations of intermated inbreds was carried out and of the five combinations screened for their major cane yield and juice quality traits, the seedling progenies from the intermated cross 1148-S4-237-2-61-43 x 1148-S4-252-170-66 (S8xS7) recorded the least variability. Among the traits under observation, cane diameter had the least variability (coefficient of variation=4.24) followed by H.R. brix, cane height, single cane weight. Number of millable canes/clump recorded the maximum variability in this population. This cross was characterized by a large proportion of recombinants exceeding the cross average for HR brix and single cane weight. Greenish purple with grey tinge was the predominant stalk color group comprising of 62.50% (60) progenies while 37.50 % progenies were characterized by yellow green colored stalk.

(R.M. Shanthi and S. Alarmelu)

All India Coordinated Research Project (Sugarcane)

Peninsular Zone

Advanced varietal Trial (Mean of two plant and ratoon trials -2022-24): Twelve entries were evaluated under AVT I plant during 2022-23 and AVT II plant and AVT ratoon during 2023-24. Co 17001 with a sugar yield of 18.43 t/ha was superior to the commercial variety Co 86032 (15.54 t/ha) and recorded 18.59% improvement over the standard Co 86032. Other entries recording higher sugar yield than Co 86032 were Co 17004 (17.18 t/ha), Co 17002 (16.86 t/ha) and MS 17082 (16.08 t/ha). For cane yield, Co 17004 (127.10 t/ha), Co 17001 (119.87 t/ha) and MS 17082 (117.9 t/ha) were found superior to Co 86032 (115.84 t/ha) and they recorded 9.72% and 3.48% and 1.78% improvement over Co 86032 for cane yield at harvest. The clone Co 17001 (21.56 %) recorded numerically higher sucrose% over the best standard Co 09004 (21.50%). Co 17001 (15.24 %) also recorded relatively higher CCS % at harvest than the best quality standard Co 09004 (15.13%)

Pooled analysis of two plant and one ratoon crops (2022-2024)

S. No.	Clone	CCS yield (t/ha)	Cane yield (t/ha)	CCS % (12m)	Sucrose % (12m)
1	Co 17001	18.43	119.87	15.24	21.56
2	Co 17002	16.86	101.00	13.42	19.20
3	Co 17003	13.81	94.55	14.55	20.63
4	Co 17004	17.18	127.10	13.54	19.39
5	Co 17005	15.72	110.20	14.21	20.21
6	Co 17010	13.94	103.64	13.43	19.13
7	Co 17012	15.38	112.57	13.58	19.23
8	Co 17013	15.56	112.40	13.66	19.49
9	CoVC 17061	15.54	85.49	13.31	18.91
10	CoN 17072	12.92	106.05	12.01	17.27
11	MS 17082	16.08	117.90	13.46	19.29
12	CoT 17366	13.24	101.69	12.89	18.44
Standards					
1	Co 86032	15.54	115.84	13.32	18.98
3	CoC 671	14.94	97.73	15.08	21.32
2	Co 09004	16.95	112.21	15.13	21.50

Initial Varietal trial- 2023-24: Twenty entries including three checks *viz.*, Co 86032, CoC 671 and Co 09004 were evaluated for cane yield and quality traits during 2023-24. Among the entries, Co 20005 recorded highest cane yield of 143.21 t/ha followed by Co 20001 (142.67 t/ha). Other entries recording significantly higher cane

yield than the check Co 86032 (120.33 t/ha) were CoSnk 20102 (141.15 t/ha), CoM 20082 (140.29 t/ha), Co 20012 (139.62 t/ha), Co 20003 (139.37 t/ha) and Co 20007 (135.61 t/ha). Five entries *viz*., Co 20005 (18.82 t/ha), Co 20010 (17.23 t/ha), Co 20007 (17.60 t/ha), Co 20003 (17.58 t/ha) and Co 20012 (17.68 t/ha) recorded significantly higher sugar yield than the best check Co 09004 (15.41 t/ha). Three test entries *viz*., Co 20009 (20.08 % and 14.14 %), Co 20010 (19.15 % and 13.40%) and Co 20005 (18.88 % and 13.13 %) recorded significantly higher sucrose content and CCS % respectively over the commercial variety Co 86032 (17.31% and 12.09 %) at 12 months. Two entries *viz*., Co 20009 (18.53%) and Co 20010 (18.51 %) recorded relatively higher sucrose % than the best standard Co 09004 (18.14%) at 10th month.

(A. Anna Durai and K. Gopalareddy)

Advanced varietal Trial-I Plant crop 2023-24: Eleven clones were under evaluation along with three standards (Co 86032, Co 09004, CoC 671). Co 09004 (20.14 t/ha) was the best standard at 12th month for sugar yield followed by Co 86032 (17.90 t/ha). Of the eleven clones under testing, Co 18013 (22.96 t/ha) ranked first for CCS yield recording a substantial improvement of 28.27 % as compared to the commercial variety Co 86032. Four other test entries *viz*., Co 18002 (22.18 t/ha), Co 18009 (22.13 t/ha), Co 18003 (21.29 t/ha), CoVC 18061 (21.18 t/ha) and CoN 18072 (19.89 t/ha) recorded a significant improvement of more than 10% over the midlate standard Co 86032. For cane yield, Co 09004 (132.37 t/ha) was the best among standards followed by Co 86032 (129.61 t/ha). Four clones *viz*., CoVC 18061 (155.70 t/ha), Co 18009 (154.70t/ha) Co 18002 (153.94 t/ha) and Co 18013 (152.99 t/ha) recorded a significant improvement of 17.62 %, 16.87%, 16.30% and 15.58 % over the best yielding standard Co 09004. Co 09004 was the best standard recording high juice sucrose values of 21.98 % and CCS% of 15.22 % while the midlate standard Co 86032 recorded 20.01 % sucrose and 13.80 % CCS at 12th month. Co 18013 was the best clone in this trial recording the highest juice sucrose value of 21.68 % at 12th month with an improvement of 8.35 % over the midlate standard while Co 18003 (21.18 %) was the second-best clone for juice sucrose with an improvement of 8.85 % over Co 86032.

(C. Appunu and R.T. Maruthi)

Advanced varietal Trial – II Plant crop 2023-24: Thirteen test entries (Co 17001, Co 17002, Co 17003, Co 17004, Co 17005, Co 17010, Co 17012, Co 17013, CoVC 17061, CoN 17072, MS 17082 and CoT 17366) and three standards (Co 86032, Co 09004 and CoC 671) were evaluated in AVT II plant trial for cane parameters and quality traits. The two entries *viz*., Co 17001 (20.89 t/ha) and Co 17004 (20.00 t/ha) were found significantly superior to Co 86032, while Co 17002 (16.73 t/ha) was found on par with Co 86032 (16.72 t/ha) for CCS yield at harvest. The entries Co 17004 (152.19) was the best in the trial for cane yield. The other clone recording relatively higher yield than Co 86032 was Co 17001 (136.11 t/ha). CoC 671 was the best entry for sucrose content at harvest (22.08 %), followed by Co 09004 (21.33 %) and none of test entries was superior to the best check for quality. However, Co 17001 (21.8 %), Co 17003 (20.51%) and Co 17005 (20.19%) were found to better than Co 86032 (18.52 %) for sucrose content.

(R. Karuppaiyan and H.K. Mahadeva Swamy)

Advanced varietal Trial -Ratoon crop 2023-24: Of the twelve clones tested in the ratoon crop, two clones *viz*., Co 17001 (11.13 t/ha), CoVC 17061 (11.48 t/ha) recorded a significant improvement of more than 10 % for sugar yield over the midlate standard Co 86032 (9.44 t/ha). For cane yield, two clones-Co 17002 (80.24 t/ha), CoVC 17061 (84.28 t/ha) recorded a significant improvement of 8.40 % and 13.86 % over the best yielding standard Co 86032 (74.02 t/ha). Co 17001 was the best clone in this trial for juice sucrose recording the highest value of 20.48 % at 11th month with an improvement of 11.00% over the midlate standard Co 86032 (18.45%). Co 17003 (20.22%) was second-best clone for juice sucrose % with an improvement of 9.59 % over the standard Co 86032.

(R.M. Shanthi and K. Elayaraja)

Exchange of seed materials 2023-24: Ten clones *viz*., Co 23001, Co 23002, Co 23006, Co 23008, Co 23009, Co 23010, Co 23014, Co 23015, Co 23016, and Co 23018 accepted during the AICRP Group Meeting held at RPCAU, Pusa in 2023 were supplied to Padegaon. Seventeen clones of 22 series *viz*., Co 22004, Co 22005, Co 22006, Co 22007, Co 22009, Co 22010, Co 22012, Co 22015, Co 22018, Co 15020, CoN 22071, VSI 22121, CoSnk 22101, CoSnk 22103, CoSnk 22105, CoSnk 22106 and CoSnk 22107 were multiplied and supplied to Mandya, Powarkheda, Pugalur, Rudrur, Sameerwadi, Sirugamani and Thiruvalla. Apart from these, 16 zonal entries of '21 series and 17 new entries of '22 series have been multiplied.

(Adhini S. Pazhany and V. Vinu)

Fluff Supply / National Hybridization Programme

Fluff Supply 2023: Fluff (weighing 25.61 kg) of crosses made at Coimbatore during 2023 flowering season was supplied to the 23 fluff receiving centres. The centres in North West Zone received the maximum quantity of 9.10 kg of fluff was followed by those in Peninsular Zone (7.60 kg). The centres in North Central & North East Zones and East Coast Zone received 4.34 and 4.57 kg of fluff respectively. Among the participating centres of fluff supply programme, Shahajahanpur centre received the highest quantity of fluff (1.67 kg) followed by Lucknow (1.45 kg).

Number of crosses effected and quantity of fluff supplied during 2023 flowering season

S.No	Centre	Biparental Crosses		Geneal Collections		Poly Crosses		Total fluff weight (g)
		No.	Fluff weight (g)	No.	Fluff weight (g)	No.	Fluff weight (g)	
Peninsular Zone								
1	Mandya	18	525.82	16	476.44	4	33.87	1036.13
2	Navsari	23	655.86	12	305.64	5	42.5	1004
3	Padegaon	22	594.85	09	213.88	5	43.71	852.44
4	Powerkheda	15	335.42	10	287.57	5	44.45	667.44
5	Pune	27	645.05	09	271.62	5	44.83	961.5
6	Rudrur	24	665.95	11	315.85	5	47.54	1029.34
7	Sankeshwar	18	456.75	15	441.36	5	44.84	942.95
8	Thiruvalla	19	476.89	16	576.2	5	48.37	1101.46
	Total	166	4356.59	98	2888.56	7	350.11	7595.26
North West Zone								
9	Gurudaspur	22	753.09	20	609.26	4	35.97	1398.32
10	Kapurthala	26	779.08	19	546.12	5	44.92	1370.12
11	Karnal	34	887.78	13	406.68	8	144.77	1439.23
12	Lucknow	32	765.57	20	638.6	5	45.94	1450.11
13	Pantnagar	14	426.33	13	370.59	3	22.84	819.76
14	Shahjahanpur	30	1021.46	29	604.08	5	47.14	1672.68
15	Uchani	20	542.53	14	350.01	6	54.91	0947.45
	Total	178	5175.84	128	3525.34	8	396.49	9097.67
East Coast Zone								
16	Anakapalle	29	798.31	15	457.06	5	46.81	1302.18
17	Cuddalore	27	773.37	09	170.12	7	67	1010.49
18	Perumalapalle	26	823.37	17	433.66	5	42.7	1299.73
19	Vuyyuru	21	560.81	16	352.24	5	48.32	961.37
	Total	103	2955.86	57	1413.08	7	204.83	4573.77
North Central and North East Zone								
20	Buralikson	10	111.09	11	356.11	4	36.72	503.92
21	Motipur	24	647.98	13	435.49	3	29.39	1112.86
22	Pusa	23	755.98	24	645.493	3	26.11	1427.583
23	Seorahi	27	759.72	15	508.74	3	30.64	1299.1
	Total	84	2274.77	63	1945.833	8	122.86	4343.463
	Grand total	531	14763.06	346	9772.813	15	1074.29	25610.16

National Hybridization Programme 2024: Four hundred and fifty parents were planted in NHG during 4th to 11th January 2024 including eight new parents *viz*., LG 15533, LG 16581, from IISR, Lucknow, UP 14234, CoS 13235, CoS 17231 from UPCSR, Shahjahanpur, CoP 18437 and CoP 20440 from SRI, Pusa and CoVC 18061 from ZARS, Mandya, which were added after quarantine. Two poly-cross nurseries comprising of eleven female and eight male parental clones for subtropics while thirteen female and eight male clones for tropical region were also planted.

Out of 450 parents in NHG 2024-25, 382 flowered with flowering intensity of 84.89 %. ICAR-SBI facilitated the 22 participating centres to effect 441 biparental crosses at NHG-2024. Nayagarh and Bathuadahari centres did not attend the crossing programme 2024. Centres from North West Zone effected maximum number of crosses (156) followed by those from Peninsular Zone (130) and North Central and North East zones and North Central Zones (96)). Centres in East Coast Zone made 59 crosses.

(A. Anna Durai and Adhini S. Pazhany)

Evaluation and identification of climate resilient ISH and IGH genetic stocks

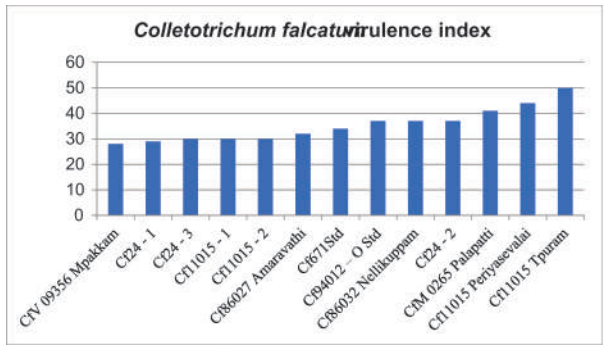
A total of 40 genotypes including 20 ISH, three IGH and 17 WL clones were maintained for supplying to the participating centres of AICRP (sugarcane).

(V. Sreenivasa and A. Anna Durai)

AICRP-Pathology

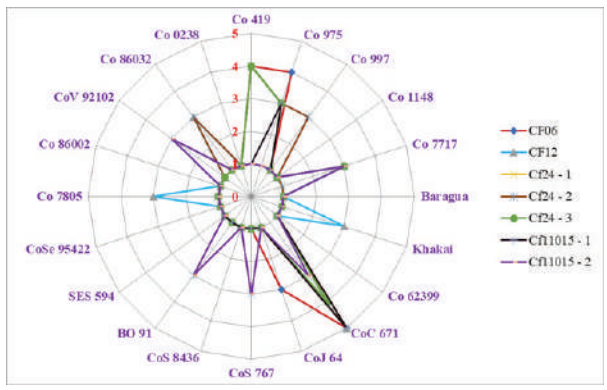
Identification of pathotypes / races of red rot pathogen

Five red rot isolates collected from various sugarcane fields during the crop season were evaluated along with eight red rot isolates including two red rot pathotypes CF06 and CF12 against 20 red rot differential varieties. Sixty days after inoculation through plug method, the inoculated canes were split-opened longitudinally and observed for red rot expression. Mostly all the isolates behaved at par with each other similar to the standard pathotypes CF06 and CF12. The isolate, *Cf11015* (Thiruvendhipuram) and *Cf11015* (Periyasevalai) was comparatively more virulent than other tested isolates result in a greater number of intermediate reactions. The isolate *CfV09356* (Mundiyampakam) was least virulent on many varieties and *Cf86032* (Nellikuppam) and *Cf24-2* isolates were highly virulent on many varieties.



Virulence index of C. falcatum isolates based on their performance on sugarcane varieties

All the isolates were virulent on known susceptible varieties CoC 671. The varieties Baragua, CoS 8436, CoSe 95422, CoV 92102 and SES 594 remained resistant to most of the tested isolates. BO 91 and Khakai were showing intermediate reactions (MS) against many isolates. The variety Co 0238 was resistant to most of the tested isolates including CF06 and CF12 whereas isolates from Co 11015 showed intermediate reactions. The isolates *Cf24-1*, *Cf24-3*, *Cf11015-1* and *Cf11015-2* were least virulent compared to other red rot isolates.



Response of selected sugarcane varieties against various C. falcatum isolates

(R. Selvakumar and R. Ramesh)

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

During May 2024, field visits were carried out in farmers field under command area of Bannari Sugar factory, Satyamangalam. The varieties CoVC 14061 and CoV 09356 were grown in larger areas. In few fields, mealybug incidence was observed along with PB. During the month of July, the command area of Ponni Sugars (Erode) Limited in Mailkalpalayam, Thottipalayam,

Velagoundampalayam and Kattur of Odappalli, Kokkarayanpettai and Patlur Divisions were surveyed for presence of sugarcane diseases *viz*., wilt, red rot, smut, PB , rust, YLD and GSD *etc*. The variety Co 86032 was cultivated in major areas followed by the varieties Co 11015 and PI 1110. The occurrence of PB was noticed in many areas and the mealy bug incidence was noticed where the fields are not maintained following standard recommended practices.

(A. Ramesh Sundar, P. Malathi, R. Selvakumar, V. Jayakumar, R. Ramesh, R. Gopi, A. Jeevalatha, and K. Nithya)

Evaluation of IVT / Zonal varieties for resistance to red rot, smut, YLD, brown rust and pokkah boeng

Screening for red rot

Thirty ZVT clones i.e., 16 IVT clones and 14 AVT clones were screened under field conditions for red rot resistance against CF06 and CF12 by both plug and nodal methods. Among IVT clones screened against CF06 pathotype 2 entries *viz*., Co 21003 and Co 21006 showed R reaction, 11 exhibited MR, 1 was MS and 2 were S by plug method, whereas 13 showed R and 3 exhibited S reaction by nodal method of inoculation. Against CF12 pathotype one entry *viz*., Co 21003 exhibited R reaction, while 12 were MR and one entry each showed MS, S and HS reactions by plug method, whereas 14 were R and 2 were S by nodal method of inoculation. Among 14 AVT entries screened against CF06 pathotype 1 entry *viz*., CoR 19141 showed R reaction, while 11 were MR and 2 were MS by plug method, whereas 13 were R and 1 was S by nodal method. Against CF12 pathotype 11 entries showed MR and 3 entries exhibited MS reaction by plug method, whereas 13 were R and 1 was S by nodal method of inoculation.

(V. Jayakumar, R. Ramesh and A. Ramesh Sundar)

Screening for smut

Screening for smut resistance in sugarcane for the crop season -2024-25, (PZVT- 2023 series) was carried out in the VPT experimental farm. Out of the 74 clones evaluated for smut resistance along with resistance and susceptible standards, 3 clones were resistant (R), 6 clones were moderately resistant (MR), 8 clones were moderately susceptible (MS), 11 clones were susceptible (S) and 46 clones were found to be highly susceptible (HS).

(R. Ramesh, R. Gopi and A. Ramesh Sundar)

Screening for YLD

IVT and AVT entries were monitored throughout the crop season with regard to YL severity based on the 0-5 scale. In IVT, out of 19 entries 73.68% were R, Co 21009, CoN 21071, CoN 21072, CoT 21366 and standards Co 86032, CoC 671 had shown YLD with severity grade of S; in AVT-I plant 35.29% were R (Co 19005, Co 19008, Co 19009, Co 19014, CoT 18369, Co 09004), 23.52% were MR, and the remaining 41% were S and HS. Of 14 entries in AVT II plant 71.42% were R, Co 18009, and CoVSI 18121 were MR, CoC 671 and Co 86032 were S and HS respectively. In AVT-I ratoon, Co 18001 had shown HS, CoC 671 and Co 86032 were S and the remaining entries were identified as R.

(K. Nithya and P. Malathi)

Screening for brown rust and pokkah boeng

IVT, AVT and ZV trials were monitored for presence of any foliar diseases at regular intervals. In PZVT, brown rust was observed on PZVT 2023-189, 2023-295, 2023-10, 2023-33, 2023-115, 2023-231. *Pokkah Boeng* was observed on 2022-27, 2023-8, 2023-270, 2023-10, 2023-95, 2023-37, 2023-13, 2023-283, 2023-153 and 2023-259. In AVT-I, CoT 18369 had rust incidence and in AVT-II plant trials, the entry CoN 18071 showed rust susceptibility and Co 18001 showed PB. In NHG, leaf spots were observed on CoPant 97222, CoPant 88220 and BO 17. Wilt symptom was observed on Co 94012, Co 97015, Co 94008, Co 1148 and ISH 229.

(Rust – R. Selvakumar and R. Gopi)
(Pokkah boeng – R. Selvakumar and A. Jeevalatha)

Efficient delivery of fungicides and other agro-inputs to manage major fungal diseases in sugarcane

Based on our earlier findings, combination of Azoxystrobin – 50ppm (0.2ml) + Propiconazole – 75ppm (0.3ml) + Thiamethoxam - 60ppm (0.3ml) has been used to treat breeding clones *viz*., NHG (410); SISMA (40 varieties of 40 two budded setts each); Agronomy (14 varieties of 1000 two budded setts each); ECC Museum plot (34 varieties of 4600 two budded setts); single bud setts of seed material from Soil Science and Tissue Culture and Technology Park (16 varieties of 250 two budded setts each) at the institute level in order to demonstrate the efficacy of mechanized sett treatment to prevent pest and disease incidence. In addition, FYM enriched with Trichoderma has been applied in NHG for wilt management. Observations on three months old crop of NHG clones indicated absence of pest and

disease incidence and at 5 months stage there was mild incidence of *pokkah boeng* as compared to untreated plots as compared to heavy incidence in nearby plots. *Pokkah boeng* and mealy bug incidence observed in all the plots was due to spread of *pokkah boeng* and mealy bug inoculum from heavily infested ratoon crop, which was taken care of by two rounds of spray with propiconazole 25EC @ 0.5ml/L and thiomethoxyam 75SG @ 0.3g/L

(P. Malathi and A. Ramesh Sundar)

Management of YLD through meristem culture

Meristem culture derived tissue culture materials of Co 11015 and Co 86032 were maintained under field conditions along with the infected control or diseased material and with the apparently healthy of the same variety. YLD severity was assessed in all the materials using the 0-5 scale. The TC seedlings of both the varieties had not shown any YLD whereas the diseased material had shown YLD with a severity grade of HS.

(K. Nithya, P. Malathi and D. Neelamathi)

AICRP(S) Entomology

Evaluation of zonal varieties/genotypes for their reaction against major insect pests

In AVT-I, the cumulative incidence of shoot borer (SB) varied from 4.8% (Co 86032) to 38% (Co 18002). Out of 14 entries, including two checks, six entries scored "T" reaction, whereas the rest eight scored "MT" reaction to the borer. Incidence and intensity of internode borer (INB) was recorded in AVT-I at harvest. Incidence of the borer ranged between 19.4% (CoN 18072) and 48.2% (CoC 671). The intensity of attack, calculated based on number of internodes attacked per cane, was the lowest (0.96) in CoN 18072 and highest (2.63) in CoC 671. Thus, out of 14 entries including two check entries, one entry (CoN 18072) was Tolerant (T), 10 entries were Moderately Tolerant (MT) and three entries were susceptible (S).

In AVT-II, the cumulative incidence of SB was the least (4.6%) in Co 17002 and maximum (29.9%) in Co 17004. However, number of bored plants/ha was the lowest (2623) in Co 17012 and the highest (11265) in MS 17082. Thus, out of 14 entries including three checks, ten entries scored "T" reaction and the rest four scored "MT" reaction. In AVT-II, the incidence of INB varied from 32.8% (CoT 17366) to 61.5% (Co 17013). The intensity of attack by the borer was the lowest (1.8) in CoVC 17061 and the highest (3.8) in CoN 17072. Out of 15 entries in the trial, two entries were tolerant and the rest 13 entries were susceptible.

In AVT-Ratoon crop, the incidence of INB varied from 29.09% (CoT 17366) to 53.4% (Co 09004). The intensity of attack was the lowest (1.67) in Co 86032 and the highest (4.26) in MS 17082. Out of 15 entries in this trial, nine entries recorded "MT" reaction whereas six entries recorded "S" reaction to the borer.

(B. Singaravelu, T. Ramasubramanian, P. Mahesh, and M. Punithavalli)

Survey and surveillance of sugarcane insect pests

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/m^2. High incidence of whitefly incidence was noticed in a field at Coimbatore. Other pests like mealybug and white woolly aphid were low in individual farmers' fields which were kept under check by periodical detrashing and natural enemies respectively. Incidence of Crown Mealybug *Phenacoccus saccharifolii* was observed in Anthiyur area under Erode District of Tamil Nadu and also in Ariyalur District. The variety CoV 09356 was most affected and Co 86032 was least affected among the varieties. The affected plants had severe yellowing, sooty mould development stunting, drying /rotting of the central whorl, failure to produce canes, profuse grassy tillering as well as failure of establishment of sprouted ratoons. The farmers are following the recommendations made earlier years for its management and it is now under check compared to previous years.

High incidence of whitefly and pyrilla was noticed in Barwani District of Madhya Pradesh. Colonisation and distribution of *Epiricania melanoluca* has reduced the incidence of pyrilla and high population of *E. melanoluca* could be seen in the fields.

(B. Singaravelu, T. Ramasubramanian, P. Mahesh, and M. Punithavalli)

Monitoring of insect pests and bioagents in sugarcane agro-ecosystem

In monitoring plot, planted in March 2023, pest incidence was monitored at fortnightly intervals in five random spots. Shoot borer and internode borer were the borer pests but both occurred at low intensity. Shoot borer deadhearts ranged 5.1-17.7% during March-July. Internode borer incidence ranged 19.0-62.0% during September-January, but it was slightly higher at harvest. Whitefly, mealybug and yellow mite were observed at low levels. Parasitoid activity was recorded on the larvae collected and reared in the lab. *Sturmiopsis inferens* activity in shoot borer was observed to be 10.2%.

Sugarcane mealybug, *P. saccharifolii* collected from the field were observed under laboratory for the extent of natural parasitism for six months from August, 2023 – January, 2024 at fortnightly intervals. The average parasitism was observed to be 30.8, 39.7, 23.0, 28.3, 19.8 and 9.3% during first fortnight of August-January. The corresponding values for the second fortnight was 32.0, 16.5, 21.3, 7.4, 16.5 and 6.3% respectively. The parasitoid species were identified as *Leptomastix sylvae*, *Aenasius hayati* and *Promucidea unfasciativentris*. The activity of parasitoids was observed to be higher in August, 2023 and lower in January, 2024.

The extent of parasitism by the dominant species, *Leptomastix sylvae* was observed under laboratory for more than a year starting from December, 2022 to February, 2024. It was in the range of 0.0-80.0% with the mean value of 18.1%.

(B. Singaravelu, T. Ramasubramanian, P. Mahesh, and M. Punithavalli)

Assessment of yield losses caused by Crown Mealybug of sugarcane under changing climate scenario

Yield loss due to Crown Mealybug (CMB) was assessed at the time of harvest in the variety Co 11015. Healthy canes and mealybug affected canes were selected randomly from and different parameters *viz*., cane length, diameter, number of internodes and cane weight were assessed in 105 affected canes and healthy canes. It has been noted that CMB has caused 29% reduction in cane length, 15.75% reduction in girth, 50.35% reduction in cane weight, 10.76% reduction in number of internodes and 7.1 t/ha when the incidence was 10% level.

(T. Ramasubramanian, B. Singaravelu, P. Mahesh and M. Punithavalli)

Integrated approach to manage white grubs in sugarcane

A field trial against white grub, *Holotrichia serrata* was laid out at Sathyamangalam, Erode District of Tamil Nadu, a known white grub endemic area, under M/s. Bannari Amman Sugars Ltd. during the first week of June 2023 with the treatments *viz*., *Metarhizium anisopliae* – FYM formulation, *M. anisopliae* – Chalk formulation, *M. anisopliae* – Liquid formulation, *Beauveria bassiana* – FYM formulation, *B. brongniartii* – Chalk formulation, combination product (Imidacloprid 40% + fipronil 40%) and untreated check, each replicated thrice. A two-acre field with six-month old crop planted with the popular variety Co 86032 was selected for the trial. Each replication had 40m^2 area. Before laying out the trial, grub population was recorded from one m^2 area of root zone of the crop at 10 spots selected randomly in the field heavily infested with the grub. The mean population of the grub (second instar) in pre-treatment count was 5.3/m^2. One month after imposing the treatments, grub counts were recorded from 5m^2 area in each replication by digging out the root zone and taking the total count of grubs alive. Since, the post treatment count did not show any appreciable reduction in the treatments, the trial was abandoned and would be repeated in the next coming season.

(P. Mahesh, B. Singaravelu and T. Ramasubramanian)

AICRP on seed (Crops) – Sugarcane

Breeder Seed Production

For the year 2023-2024, an indent of about 290 tons of quality seed has been received from the Director of Sugars, Government of Tamil Nadu for subsidy scheme under NADP. Private sugar factories have indented for 805 tons and the total requirement for the breeder seed was 1095 tons. Progressive seed farmers have been selected to undertake farmers' participatory seed production from Seyur village of Tiruppur district and Neelambur village of Coimbatore district and seed production was undertaken in about 28.60 acres. The seed crops were strictly monitored and about 911.15 tons of quality seed has been supplied during February–April, 2024 to both cooperative and private sugar factories as per allotments received from Directorate of Sugar, Government of Tamil Nadu.

Maintenance breeding and multiplication of nucleus clones of varieties in seed chain *viz*., Co 86032, Co 11015, Co 18009 and Co 14012 are being undertaken at the institute farm. For the year 2024-2025, the quality seed cane material requirement from co-operative sugar mills and private factories is 392.50 tons and 2065 tons respectively, totaling to 2457.50 tons. To meet out the demand, planting was taken up in 35.98 acres in farmer's participatory mode in Coimbatore and Tiruppur districts during July to September, 2024.

Training Programmes: One day training programme on "Quality seed production" was organized for the farmers and staffs of Kothari Sugars and Chemicals Ltd., Kattur Unit, at Cane Development Area on 29.02.2024 and K J Somaiya Institute of Applied Agricultural Research (KIAAR), Sameerwadi, Belagavi District, Karnataka on 30.04.2024. In addition, a field Day

Training Programme on "Quality Seed Production" at K J Somaiya Institute of Applied Agricultural Research, Sameerwadi, Belagavi District, Karnataka

Field Day organized in Tiruppur district

Field day organized as part of AICRP on Seed (Crops)

Seed Day Organized at ECC Farm, ICAR – SBI, Coimbatore

(A.J. Prabakaran, S. Karthigeyan, A. Anna Durai, K. Mohanraj, R. Gobu, R.T. Maruthi and V. Sreenivasa (STC))

Production of tissue culture plants

Tissue culture plants were produced through apical meristem tip culture in tropical and subtropical varieties *viz*., Co 86032, Co 11015, Co 18009, Co 14012, Co 0238, Co 0118 and Co 15023 and supplied to sugar mills and farmers. A total 1,25,000 tissue culture plants were supplied to sugar factories, progressive farmers and for breeder seed production at Sugarcane Breeding Institute, Coimbatore. During this period, maximum tissue culture plants of variety Co 86032 were supplied to farmers or sugar mills of Maharashtra, Karnataka and Tamil Nadu. Farmers of Maharashtra with sugarcane nursery facility produced single budded settling from seed crop raised from tissue culture plants, which were sold to farmers of their own state and nearby states *viz*., Gujarat, Karnataka and Madhya Pradesh and the crop raised from these single budded settling yielded 70 - 80 tons / acre in variety Co 86032 by adopting good field management practices. *In-vitro* cultures of varieties *viz*., Co 86032, Co 18009, Co 14012 and Co 11015 indexed for three viruses at pathology laboratory and more than 70 % samples were found to be free from viral infection. In addition, eleven mother culture flasks of varieties Co 86032, Co 11015, Co 18009, Co 14012 and Co 0118 were supplied to four tissue culture laboratories of Tamil Nadu, Punjab and Karnataka. Total revenue of Rs 10,47,630 was generated through supply of tissue culture plants and mother culture flasks.

(D. Neelamathi, R. Valarmathi and C. Jayabose)

Externally Funded Projects

Identification, characterization and verification of new sugarcane varieties for DUS testing at Coimbatore

DUS testing for tropical sugarcane varieties is being carried out at ICAR-Sugarcane Breeding Institute, Coimbatore (Lead Centre). During 2024-25 crop season, 246 tropical RVs (Reference Varieties) of sugarcane were raised through clonal propagation. ICAR-SBI, Coimbatore centre conducted DUS tests in five varieties *viz*., Phule-11082 (CoM 11082), Phule Sugarcane 15012 (MS 17082), CoA 14321, CoA 14323, and CoM 0265. Seed cane of two new varieties (NV), *viz*., VSI 08005 (VSI 12121) from VSI, Pune, and Phule Sugarcane 13007 (MS 14082) from CSRS, Padegaon were multiplied. First year DUS testing of Phule-11082 was conducted along with closely resembling RVs and found to be distinct from the RVs (Co 8347, Co 8371, CoA 89081 and Co 7805) for DUS traits *viz*., plant growth habit, hairiness, shape of ligule, inner auricle, leaf blade curvature, adherence of leaf sheath, internode colour exposed to sun and prominence of growth ring. The other variety MS 17082 was distinct from the RVs (Co 8347, Co 8371, Co 853 and Co 6304) in respect of DUS traits *viz*., plant growth habit, hairiness, shape of ligule, inner auricle, internode colour (exposed to sun), internode shape, rind surface appearance, waxiness, bud groove and bud tip in relation to growth ring. Second year DUS testing was conducted for two new varieties *viz*., CoA 14321 and CoA 14323 along with reference varieties and zonal standards CoA 92081 and CoV 92102. The candidate variety CoA 14321 was distinct from the RVs (CoG 93076 and Co 97009) in respect of DUS traits *viz*., plant growth habit, hairiness, shape of ligule, inner auricle, internode zig-zag alignment, rind surface appearance and waxiness. The other candidate variety CoA 14323 was distinct from the RVs (CoC 773 and Co 7527) in respect of DUS traits *viz*., growth habit, ligule, inner auricle, leaf sheath curvature, internode shape, internode zig-zag alignment and growth crack. Though these two candidate varieties were distinct from their respective reference varieties, they differed from each other only for the traits namely shape of ligule and leaf blade curvature. The extant variety CoM 0265 (EV) was distinct from the RVs (Co 87044 and CoN 07072) for DUS traits *viz*., hairiness, ligule, inner auricle, colour of dewlap, leaf blade curvature, adherence of leaf sheath, internode shape, zig-zag alignment, growth crack, shape of bud, bud groove and bud tip relation to growth ring. Certificate of registration from PPV & FR authority, New Delhi was received for the released tropical varieties *viz*., Co 11015, Co 10026 and Co 12009.

(S. Alarmelu and C. Jayabose)

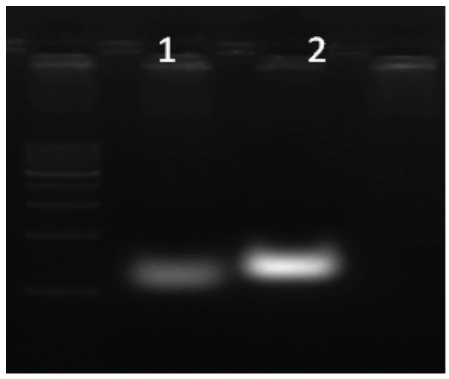
Novel application of sugarcane vacuolar targeting technology for recombinant protein

The project was initiated to validate the vacuolar technology developed by ICAR-SBI for the production of commercial recombinant protein in sugarcane. A total of 89 transgenic events were generated and all of them were analyzed for the presence/absence of transgene by promoter and gene fusion amplification using PCR. Fifty-six events were found positive with an amplicon size of 968bp. Untransformed control did not show signal. The expression of Glucocerebrosidase (GCS) was quantified using quantitative PCR. Further, juice was extracted and tested for GCS in SDS PAGE. All events were grouped in three categories as low, medium and high-level expression. Representative sample from each category was further analyzed through microplate assay. Some of the events could reach the high expression level of fifty nanograms of GCS per 100 ml of juice.

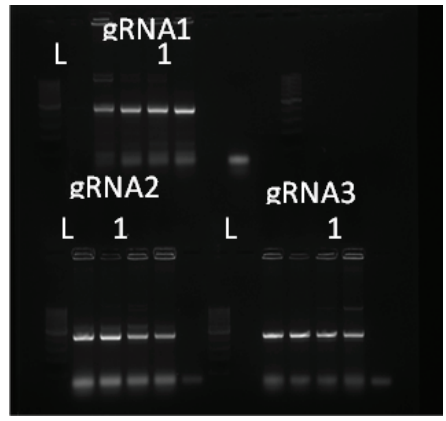
(C. Appunu and G.S. Suresha)

CRISPR/Cas mediated targeted editing for virus resistance in sugarcane

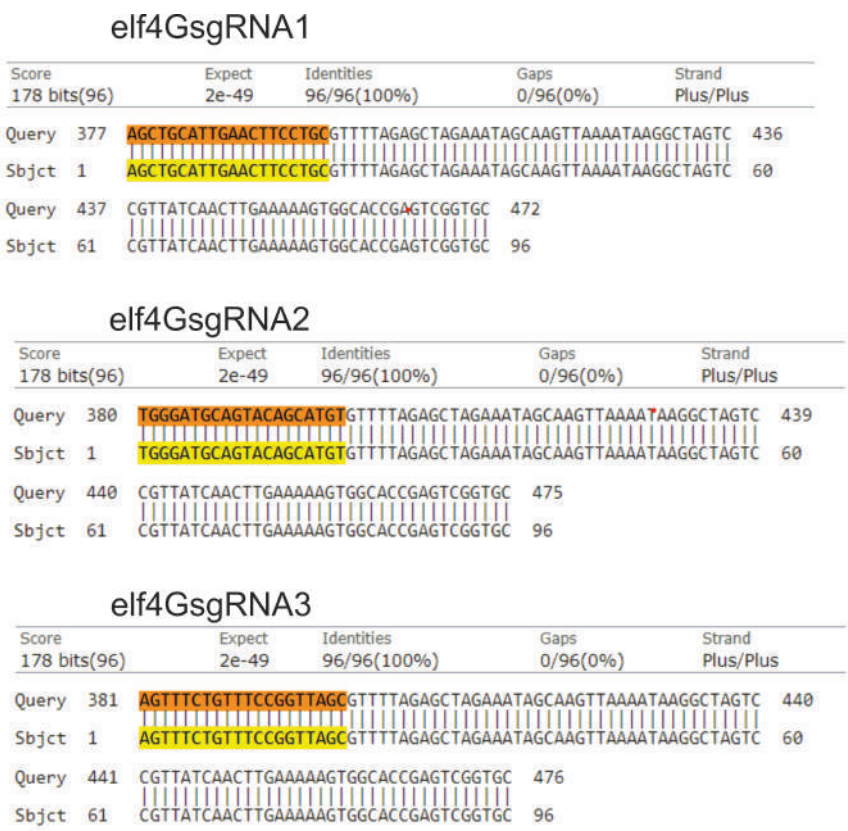
Yellow leaf disease (YLD) caused by Sugarcane yellow leaf virus (ScYLV) occurs in sugarcane across the varieties. One of the most efficient and sustainable strategies for controlling plant virus infections is the use of genetically resistant plants. Four CRISPR/Cas9 guide RNAs viz., pCas9-eIF4G-gRNA1, pCas9-eIF4G-gRNA2, pCas9-eIF4G-gRNA3 and pCas9-eIF4G-gRNA4 were used to develop edits. Forward and reverse gRNA annealing was executed before cloning in the binary vector. Before the binary vector transformation, constructs were confirmation through restriction and sequence analysis. These constructs were transferred to *E. coli* and later mobilized into *Agrobacterium tumefaciens* LBA4404 strain. After the confirmation, *Agrobacterium* mediated transformation was performed by co-culturing with leaf whorl. A total 44 V0 mutants selected on hygromycin- containing media were first examined for the amplification of *hpt* gene by PCR. The mutation rate for the individual constructs was 3.6% (gRNA1), 1.83% (gRNA2) and 2.35% (gRNA3). Selected edits underwent sequencing analysis. All these mutants (V0) further multiplied vegetatively using single bud setts to get V1 generation.



Forward and reverse sgRNA of elf4G gene annealing confirmation before cloning in the binary vector pRGEB32 (Lane 1. Oligo primers; Lane 2. Annealed Oligo primers).



SgRNA recombinant plasmid confirmation through colony PCR analysis (M13 primers)

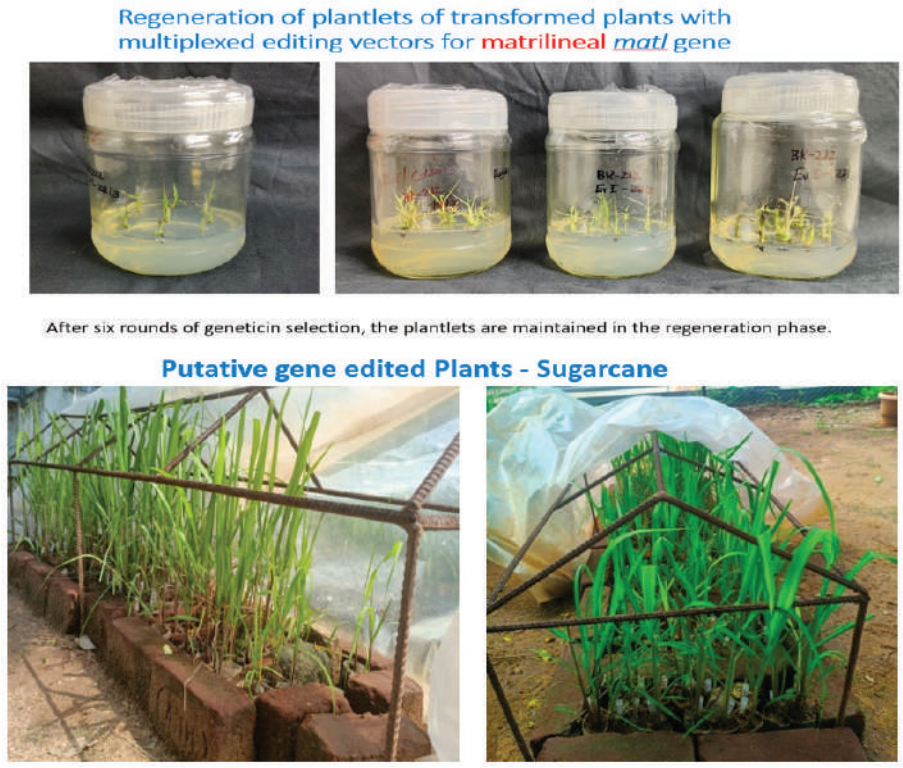


SgRNA recombinant plasmid confirmation through sequence analysis

(C. Appunu, K. Nithya and R. Valarmathi)

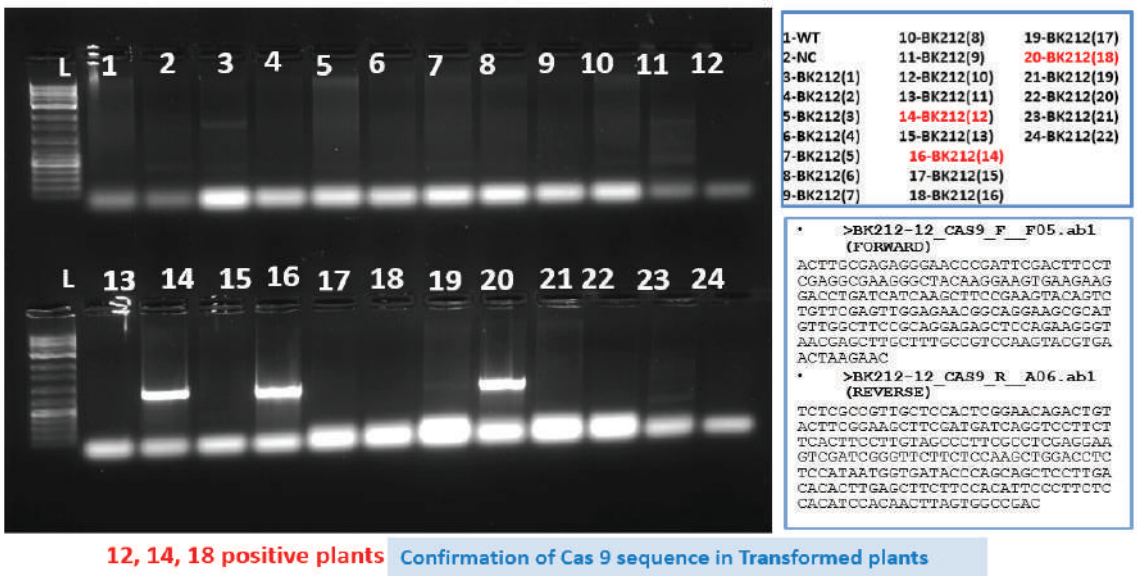
CRISPR Crop Network: Targeted improvement of stress tolerance, nutritional quality and yield of crops by using Genome Editing

Putative Transgenic Plants transferred to Glass house: Plantlets transformed with multiplexed editing vectors targeting the matrilineal *matl* gene were regenerated after six rounds of selection and maintained in the regeneration phase. More than 200 putative transgenic sugarcane plants were successfully generated and transferred from the rooting medium to the polybags by following SOP. The plants were acclimatized in a net house for *ex vitro* conditions.



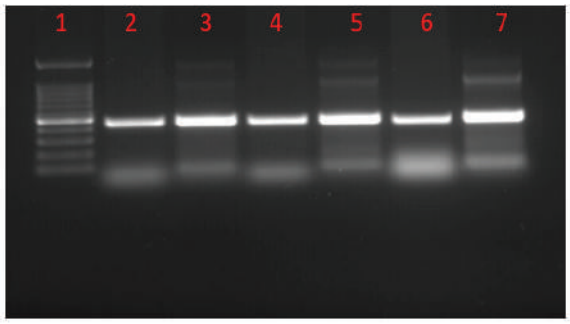
Images of putative transgenic plants

PCR based screening of Putative transgenic lines using Cas9 primer: To screen gene-edited plants, DNA was isolated from 120 plants and PCR was done to identify putative transgenic lines using Cas9-specific primers. The Cas9 primer pair (5' AAGGACCTGATCATCAAGCTTCC 3'; 5' CGAAGTTATGCGATCGCGGTA 3') was designed based on the binary vector BK Cas9. BK 212 (12), BK212(14), BK212 (18) were identified as Cas9 positive plants and confirmed through sequencing.



PCR based screening of T0 plants with Cas9 specific primers

Cas9 Positive plants amplification with mutation primer:
Three cas9 positive plants BK 212 (12), BK 212(14), BK 212 (18) were used for PCR amplification using mutation primer and the product was separated using 1.2% agarose gel. Amplification of specific size 450 bp was obtained. The sequencing showed the confirmation of edited *matl* gene in the transformed plants.



Amplification of *matl* gene in putative transformed plants. 1-100bp ladder, 2, 3- BK212 (12),4,5-BK212(14) ,6,7 -Bk212(18).

>PCR_BK212_12_BK212FP_E10.ab1

CGGGGAGGGTGCATCGGCACGTCCGCCGCGCCGACCTACCTCCCGGCGCACTACTTCCAGACCAAGGACGCCGCC
AGTGGCAAGGAACGCGAGTACAACCTCATCGACGGCGGTGTGGCGGCCAACAATCCGGTAATTAATTAACTGAA
AAACGAACGCAAAGTCCATGTATATCCATCGTCCAGAAGATCGATGCTAATTGTTGCTTAGGCACGTCGCCCGATT
GCACATGCGTAGACGATGGTTGCGATGACGCAGATCACCAAGAAGATGCTTGCCAGCAAGGACAAGGCCGAGGA
GCTGTACCCAGTTAAGCCGTCGGAGTGCCGCAAGTTCCTGGTGCTGTCCATCGGGACGGGGTCGACGTCGGACCA
GGGCCTCTACACGGCGCGGCAGTGCTCGCGGTGGGGCATCTGCCGGTGGATCCGTAAAAA

>PCR_BK212_14_BK212FP_G10.ab1

CCTTGGAAGGTGCATCGGCACGTCCGCCGCGCCGACCTACCTCCCGGCGCACTACTTCCAGACCAAGGACGCCGC
CAGTGGCAAGGAACGCGAGTACAACCTCATCGACGGCGGTGTGGCGGCCAACAATCCGGTAATTAATTAACTGA
AAAACGAACGCAAAGTCCATGTATATCCATCGTCCAGAAGATCGATGCTAATTGTTGCTTAGGCACGTCGCCCGAT
TGCACATGCGTAGACGATGGTTGCGATGACGCAGATCACCAAGAAGATGCTTGCCAGCAAGGACAAGGCCGAGG
AGCTGTACCCAGTTAAGCCGTCGGAGTGCCGCAAGTTCCTGGTGCTGTCCATCGGGACGGGGTCGACGTCGGACC
AGGGCCTCTACACGGCGCGGCAGTGCTCGCGGTGGGGCATCTGCCGGTGGATCCGTAAAAAT

>PCR_BK212_18_BK212FP_A11.ab1

GCCTGGACAGTGCATCGGCACGTCCGCCGCGCCGACCTACCTCCCGGCGCACTACTTCCAGACCAAGGACGCCGC
CAGTGGCAAGGAACGCGAGTACAACCTCATCGACGGCGGTGTGGCGGCCAACAATCCGGTAATTAATTAACTGA
AAAACGAACGCAAAGTCCATGTATATCCATCGTCCAGAAGATCGATGCTAATTGTTGCTTAGGCACGTCGCCCGAT
TGCACATGCGTAGACGATGGTTGCGATGACGCAGATCACCAAGAAGATGCTTGCCAGCAAGGACAAGGCCGAGG
AGCTGTACCCAGTTAAGCCGTCGGAGTGCCGCAAGTTCCTGGTGCTGTCCATCGGGACGGGGTCGACGTCGGACC
AGGGCCTCTACACGGCGCGGCAGTGCTCGCGGTGGGGCATCTGCCGGTGGATCCGTAAAAATAT

(Mutation outside the seed region)

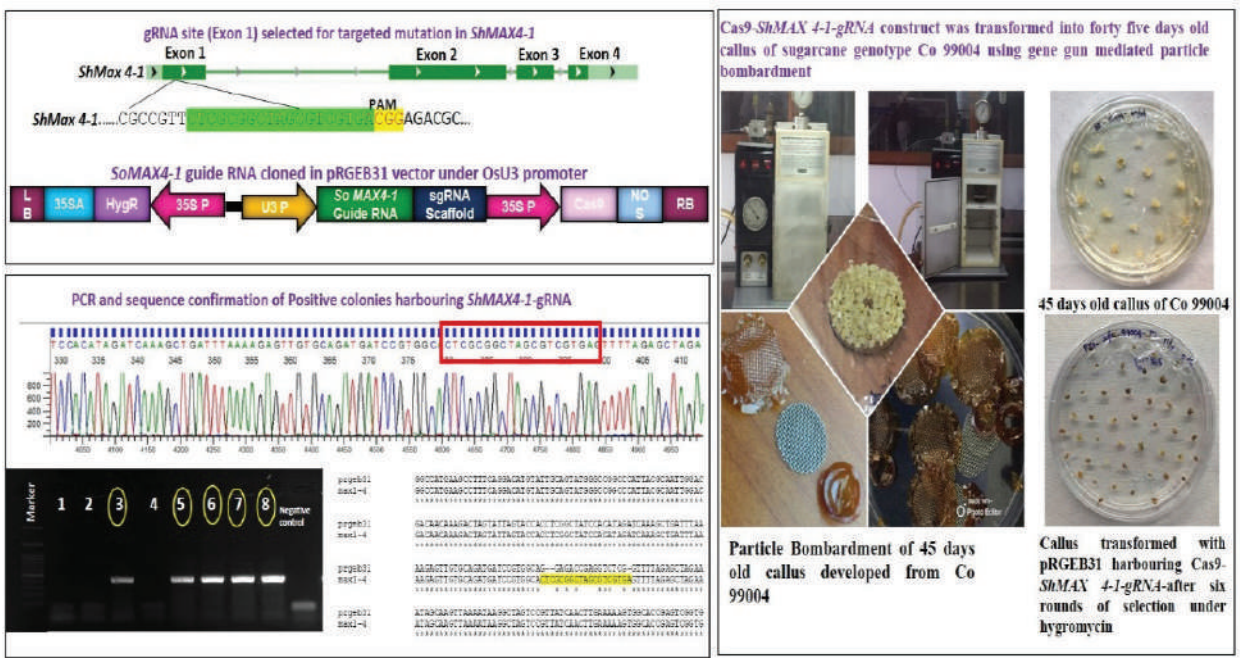
Confirmation of *matl* gene in Transformed plants

Screening of transformed plants with mutation specific primer

(R. Manimekalai, V.P. Sobakumari and C. Appunu)

Improving tillering and yield in sugarcane through creating novel alleles of strigolactone biosynthesis gene MAX4-1 using CRISPR / CAS9

Genes controlling tillering can be prime targets for improving sugarcane genotypes with higher yields. Targeted genome engineering or gene editing of such genes requires a strong understanding on gene function. Strigolactones (SL) are known branching inhibitors produced through the CAROTENOID CLEAVAGE DIOXYGENASE (CCD) pathway sequentially regulated by MAX2, MAX3 and MAX4 (More Axillary Branching) genes. Synthesis of strigolactone (SL) starts with the all trans β-carotene, which is converted to 9-cis-β-carotene by the activity of Dwarf 27 (D27), MAX3 then converts it into 9 cis β–apo 10′-carotenal, MAX4 converts 9 cis β–apo 10′-carotenal to strigolactone precursor called carlactone. The co-regulation of MAX3, MAX4 and a receptor (MAX2) result in producing the branch-inhibiting hormone called strigolactone. Strigolactone interacts with auxin and inhibits side branching and thus a strong negative regulator for tillering. Through functional genomics on tillering behaviour in sugarcane, a strong candidate gene negatively regulating tillering gene (More Axillary Branching (MAX4-1)) was identified and characterised from sugarcane (*Saccharum* hybrid). MAX4 is involved in strigolactone biosynthesis and inhibits tillering in sugarcane. Knock out lines of MAX4 gene was created through CRISPR/Cas9 mediated genome editing to improve tillering and yield in sugarcane. *ShMAX4-1* SgRNA was designed using CRISPR-PLANT platform. MAXsgRNA with appropriate adaptors was cloned at *Bsa* I restriction site under OsU3 promoter in the plant transformation vector pRGEB31 harboring hygromycin resistant gene as the selectable marker. The construct was mobilized into *E.Coli* and putative plasmid was confirmed for the presence of 20bp protospacer sequence using PCR and Sanger sequencing. The putative positive plasmid DNA harbouring *ShMAX4-1* SgRNA was used for transformation into a selected sugarcane genotype (Co 99004) having high sugar content and high quality, but exhibits shy tillering. Putative positive Cas9-*ShMAX 4-1-gRNA* construct was transformed using particle bombardment into forty-five days old callus developed from Co 99004. Fifty to sixty percent white friable calli was successfully obtained after six rounds of selection in hygromycin selection medium. A total of 550 putative edited plants from 16 putative events were successfully generated through particle bombardment. The plants are currently screened for the mutation in the target site.

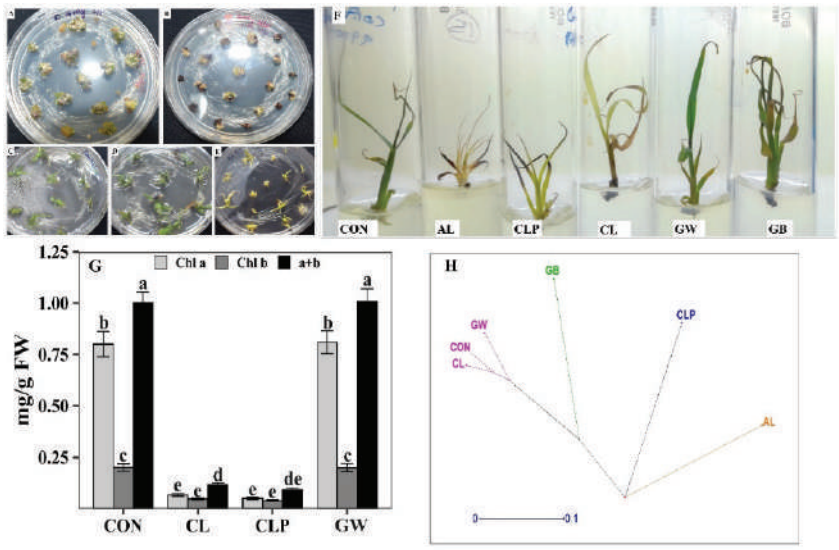


Improving tillering and yield in sugarcane through creating novel alleles of strigolactone biosynthesis gene MAX4-1 using CRISPR / CAS9

(R. Valarmathi, C. Appunu and K. Mohanraj)

Deciphering the genetic basis of root-system architecture for developing climate resilient sugarcane

To understand the genetic basis of root system architecture in sugarcane, contrasting sugarcane genotypes were screened for root system architecture (RSA) related traits under control and drought stress conditions. Genomic study has been carried out on whole genome transcriptome analyses to delineate the genes/ regulatory network(s) associated with RSA in selected drought tolerant contrasting genotypes and to identify candidate genes controlling drought adaptive root traits. The phenotypic response of a commercial sugarcane genotype Co 99004 to gamma ray induced in-vitro mutagenesis was studied. The sugarcane genotype produced five distinct phenotypically scorable mutants from the gamma ray induced *in-vitro* callus. The gamma treatment produced three chlorophyll mutants (albina, chlorina and chlorina pigmented) and two green mutants similar to wild type control. The SRAP marker analyses distinctively differentiated the gamma radiation induced genomic variation among the phenotypic mutants and the untreated control. The polymorphic information content (PIC) among the mutants and control ranged from 0- 0.472. The phylogenetic dendrogram derived from the SRAP marker data grouped the phenotypic mutants into four distinct clusters. The selected SRAP amplicon sequencing indicated deletion of fragments encoding for genes such as FAR1-RELATED SEQUENCE 5-like protein involved in chlorophyll biosynthesis in the albina and chlorina mutants. Characterization of secondary metabolites indicated that, the radiation induced chlorophyll mutants with lethal chlorophyll biosynthesis, MEP and fatty acid biosynthesis pathway, indicating a lethal mutation in these mutants. A comparative transcriptome data on the root less chlorina mutant, green rooting and wild type was developed. The number of reads ranged from 32 million to 44 million and all the samples showed more than 98.52% high quality reads. The annotated data lead to the identification of regulatory genes including transcription factors, kinases, phosphatases, and transcripts involved in phytohormone signalling that exhibits differential expression during rooting. The mutants were further screened for RSA using image-based analyses and good rooting mutants were planted in pot and field conditions and screened for their drought tolerance.



A-E Regeneration of mutant plants from gamma ray irradiated callus Phenotypic observation and phylogenetic analysis of mutants using SRAP molecular markers. Different phenotypic mutants obtained from gamma irradiated callus of Co 99004 (F), Chlorophyll content measured among mutants and control, the different alphabets over bar indicates the significant difference at 5 % level (p <0.05%) (G), Phylogenetic tree derived from the SRAP marker data of mutants and control (H). CON – control, AL – albino, CL – chlorina, CLP – chlorina pigmented, GW – green wild type, GB- Green broad leaves.

(R. Valarmathi, C. Appunu and Dr. Ashish Kumar Srivastava (Scientific Officer F, BARC))

Identification and characterization of SWEET genes associated with sugar content and disease susceptibility in sugarcane

Developmental regulation of SWEET genes expression in high and low sugar genotypes of sugarcane from 6th month till 12th month of planting was observed. A total of ten contrasting pairs of high and low sucrose varieties of sugarcane were planted for expression studies. The quantitative expression of thirteen SWEET genes was studied in two high sugar (Co 86032 and Co 11015) and two low sugar (Co 62175 and MS 68/47) genotypes of sugarcane to check their differential expression for sucrose accumulation using quantitative real time RT-PCR.

(P.T. Prathima, A. Selvi, R. Manimekalai and K. Lakshmi)

DUS Testing Project-Sugarcane (Agali Centre)

Maintenance of Reference varieties: A total of 246 tropical sugarcane Reference Varieties (RVs) were maintained through clonal propagation at ICAR-SBI RC, Agali centre.

Multiplication of seed cane of candidate varieties: Seed cane of two new varieties (NV), namely VSI 08005 (VSI 12121) and Phule Sugarcane 13007 (MS 14082) received from VSI, Pune, and CSRS, Padegaon centres were multiplied. The two candidate varieties along with their respective Reference Varieties (RVs) - Co 8347, Co 94008, Co 62175 (for VSI 08005) and CoC 773, 93 V 297, CoM 0265 for Phule Sugarcane 13007 were planted in the field. DUS test was conducted for 5 varieties namely, Phule-11082 (CoM 11082), Phule Sugarcane 15012 (MS 17082), CoA 14321, CoA 14323, and CoM 0265.

First-year DUS testing: (i) Phule-11082 (CoM 11082) was found distinct from the RVs (Co 8347, Co 8371, CoA 89081 and Co 7805) for DUS traits like, plant growth habit, hairiness, shape of ligule, inner auricle, leaf blade curvature, adherence of leaf sheath, internode colour exposed to sun and prominence of growth ring. ii) Phule Sugarcane 15012 (MS 17082) was distinct from the RVs (Co 8347, Co 8371, Co 853 and Co 6304) in respect of DUS traits *viz*., plant growth habit, hairiness, shape of ligule, inner auricle, internode colour (exposed to sun), internode shape, rind surface appearance, waxiness, bud groove and bud tip in relation to growth ring.

Second year DUS testing: (i) The candidate variety CoA 14321 (NV) was distinct from the RVs (CoG 93076 and Co 97009) in respect of DUS traits *viz*., plant growth

habit, hairiness, shape of ligule, inner auricle, internode zig-zag alignment, rind surface appearance and waxiness. (ii) The candidate variety CoA 14323 (NV) was distinct from the RVs (CoC 773 and Co 7527) in respect of DUS traits *viz*., growth habit, ligule, inner auricle, leaf sheath curvature, internode shape, internode zig-zag alignment and growth crack. Though the candidate varieties CoA 14321 (NV) and CoA 14323 (NV) were distinct from their respective reference varieties, they differed from each other only for the traits *viz*., shape of ligule and leaf blade curvature. (iii) The Extant variety CoM 0265 (EV) was distinct from the RVs (Co 87044 and CoN 07072) in respect of DUS traits *viz*., hairiness, ligule, inner auricle, colour of dewlap, leaf blade curvature, adherence of leaf sheath, internode shape, zig-zag alignment, growth crack, shape of bud, bud groove and bud tip relation to growth ring.

(R.T. Maruthi and R. Karuppaiyan)

Public–Private Partnership Projects

Enhancing Sugar Productivity in Tamil Nadu through Institute-Industry Participatory Approach (SISMA-TN funded – Sweet Bloom 2.0)

Seed cane supply: Seed cane material of seventeen promising clones were supplied to ten factories during June-July 2022 for further multiplication at respective factory locations.

'Co' canes: A total of seventeen genotypes (Co 15010, Co 15017, Co 15020, Co 18001, Co 19002, Co 19004, Co 19008, Co 19009, Co 20005, Co 20009, Co 20010, Co 20011, Co 21003, Co 21004 and Co 21007) were evaluated in following ten sugar factory locations during 2023-24 as given in the table below.

Performance of varieties:

Seventeen test genotypes were evaluated along with Co 86032 and local standards in a replicated trial during 2023-24. Harvesting was completed in all factory locations before the end of February 2024. Overall, two clones *viz*., Co 19009 and Co 20011 performed better than Co 86032 for yield and quality at harvest (12 months). Clones recording more than ten percent improvement for cane yield and cane yield and higher sucrose % than Co 86032 (12 months of planting) were identified as suitable for particular locations. Genotypes suitable for different crushing times are given factory-wise in the table. Test clones that recorded higher cane yield and sucrose % than Co 86032 were considered for classification.

Genotypes identified for crushing at different maturity periods

S. No	Sugar Factory	Genotypes identified for crushing at		
		8 m (240 days)	10 m (300 days)	12 m (360 days)
1	Bannari Amman Sugars, Sathy	Co 15017, Co 20009, Co 20010	Co 15010, Co 15017, Co 19002, Co 20005, Co 20009, Co 20010, Co 21003, Co 21004, Co 21007	Co 15010, Co 15017, Co 19002, Co 19004, Co 19009, Co 20005, Co 20009, Co 20010, Co 20011, Co 21004, Co 21007, G 11035
2	BAS, Tirukovilur	Nil	Co 21007	Co 20009, Co 20010, Co 21004, Co 21007
3	Dhanalakshmi Srinivasan	Co 19002	Co 20009, Co 20010, Co 21007	Co 15010, Co 20009, Co 20010, Co 20011, Co 21007
4	EID Parry (India)	Co 20009, Co 20010, Co 21007	Co 20009, Co 20010, Co 21007	Co 15017, Co 20005, Co 20009, Co 20010, Co 20011, Co 21003, Co 21007
5	Kothari Sugars Kattur	Co 19002, Co 19004, Co 20011, Co 21003, Co 21007	Co 15017, Co 19002, Co 21003, Co 21007	Co 15017, Co 15020, Co 18001, Co 19002, Co 19009, Co 20005, Co 20009, Co 20010, Co 20011, Co 21003, Co 21004, Co 21007, C 2015-095

S. No	Sugar Factory	Genotypes identified for crushing at		
		8 m (240 days)	10 m (300 days)	12 m (360 days)
6	Kothari Sugars Sathamangalam	Co 15010, Co 15017, Co 15020, Co 19002, Co 19004, Co 20005, Co 20009, Co 20010, Co 20011, Co 21007	Co 15017, Co 20010, Co 21003, Co 21007	Co 15010, Co 15017, Co 19004, Co 20010, Co 21004, Co 21007, G 11035
7	Ponni Sugars	Co 15017, Co 20009, Co 20010, Co 21007	Co 15020, Co 19002, Co 19004, Co 20005, Co 20009, Co 20010, Co 20011, Co 21003, Co 21007	Co 15020, Co 20005, Co 20009, Co 20010, Co 21007
8	Rajshree Mundiampakkam	Nil	Co 15017, Co 15020, Co 20009, Co 21007	Co 15017, Co 15020, Co 19004, Co 20009, Co 20010, Co 21007, G 11035
9	Sakthi Sugars Appakudal	Co 21007	Co 15020, Co 20009, Co 20010, Co 21007	Co 20010, Co 21007
10	Sakthi Sugars Sivagangai	Nil	Co 20009, Co 20010, Co 21007	Co 15017, Co 18001, Co 20009, Co 20010, Co 20011, Co 21004, Co 21007

Co 21007 with high quality was found suitable for harvesting at 8 months at five factory locations and thus considered as a short duration variety. Two test entries *viz.*, Co 20009 and Co 20010 recorded higher sucrose than the standard at four factories and amenable for early harvest at 8 months.

Identification of location specific clones (2024-2025): Second plant crop trial was planted in all sugar factory locations. First plant crop was harvested and ratooned to evaluate the ratooning potential of seventeen Co varieties.

Multiplication of second set of clones for location specific variety trial: Twenty promising sugarcane clones *viz.*, Co 21002, Co 21006, Co 22004, Co 22009, Co 22010, Co 22015, Co 22016, Co 23002, Co 23006, Co 23007, Co 23008, Co 23009, Co 23010, Co 23013, Co 23015, Co 23016, C 16338, C 22020, C 22054 and G 2008-019 were multiplied and supplied to all ten factories during August 2024.

(G. Hemaprabha (till 31.7.2024), P. Govindaraj (from 1.8.2024), C. Appunu, S. Karthigeyan, A. Annadurai, R. Karuppaiyan, K. Mohanraj, V. Sreenivasa, R.T. Maruthi, Adhini S. Pazhany, K. Elayaraja, S. Sheelamary, K. Gopalareddy, V. Vinu, H.K. Mahadeva Swamy, R. Gobu, D. Neelamathi, C. Jayabose, R. Valarmathi, K.P. Salin, A. Ramesh Sundar, B. Singaravelu, P. Malathi, R. Selvakumar and P. Mahesh)

Project Members from TNAU, Coimbatore D. Sassikumar & T. Thirumurugan, SRS Cuddalore, M. Sakila & V. Anbanandan, SRS Sirugamani, N.A. Saravanan and SRS Melalathur

Identification of suitable location specific sugarcane varieties for commercial cultivation under different agro-climatic situations in India

Tropical Zone*: (9 Sugar mills)*

Supply of seed material to Tropical sugar mills:

Co 16006, Co 17001, Co 18009, Co 17005, Co 18003, Co 19003, Co 19004, Co 19005, Co 19009, Co 19014, Co 20003, Co 20005, Co 20009, Co 21003, Co 21004, Co 21009, Co 22005, Co 22012, Co 22015, Co 22018, Co 22019, Co 24015 were supplied to nine sugar mills for multiplications and experimental trials were laid out in four sugar mills in Madhya Pradesh.

Sub-Tropical Zone: (16 Sugar mills)

Supply of seed material to Subtropical sugar mills: Seed materials of nine entries *viz.*, Co 16029, Co 16030, Co 17018, Co 19017, Co 20016, Co 20017, Co 21012, CoLk 14201 and CoLk 15207 were supplied during second

fortnight of February, 2024 and experimental trials were planted in RBD with three replications in all the 16 sugar mills in subtropical region during February, 2024.

Nine clones along with two checks *viz*., Co 0238 and Co 0118 were evaluated for cane and juice quality traits at 8th month. The entry Co 20016 recorded the highest mean cane yield of 156.45 t/ha followed by Co 16030 (151.97 t/ha). Compared to the check Co 0238 (127.08 t/ha), six clones recorded superior cane yield.

Two clones Co 20016 and Co 21012 recorded a sugar yield of 15.89 t/ha and 15.08t/ha respectively, compared to the check Co 0238 (14.30 t/ha). The highest sucrose was recorded in the entry CoLk 14201 (17.33%) followed by Co 21012 (16.34%) compared to the check Co 0238 (16.01%). Among the cane traits, the entry Co 20016 recorded the highest single cane weight of 1.75 kg compared to 1.38 kg in Co 0238.

Multiplication of entries for Trial II: Seventeen clones *viz*., Co 12027, Co 14034, Co 14035, Co 17015, Co 17016, Co 20019, Co 21014, Co 22020, Co 22021, Co 22023, CoLk 18202, CoLk 19201, CoLk 19202, CoLk 19204, CoLk 20201, CoLk 20202 and CoLk 20204 were also supplied for multiplication in all sugar mills in subtropics for planting trial during February, 2025.

Training programme organized: One day training programme was organized for staff of sugar mills in subtropical zone on 19.10.24 at ICAR SBIRC, Karnal. Thirty participants from 16 sugar mills in Bihar, Haryana and Uttar Pradesh were participated in the programme. Hands on training was provided on juice analysis in experimental trials and demonstration of sett treatment device.

(PI: G. Hemaprabha (till 31.7.2024), PI: Dr. P. Govindaraj (from 1.8.24 onwards), K. Mohanraj, V. Sreenivasa, H.K. Mahadeva Swamy, R.M. Shanthi, S. Alarmelu, A. Anna Durai, S. Karthigeyan, R. Karuppaiyan, C. Appunu, R.T. Maruthi, S. Sheela Mary, K. Elayaraja, Adhini S. Pazhany, K. Gopalareddy, V. Vinu, R. Gobu, Kona Praveen, T .Lakshmi Pathy, D. Neelamathi, A. Ramesh Sundar, Ravinder Kumar, M.R. Meena, M.L. Chhabra and M. Nisha (ICAR-SBI), R. Viswanathan, Sanjeev Kumar, AK Mall, Aalok Shiv and Indu (ICAR-IISR, Lucknow)

5.2. Crop Production

5.2.1 Agronomy, Microbiology, Farm Machinery and Power

Development of cropping systems and improved agronomic practices to enhance sugarcane productivity

Development and promotion of tools and machinery for sugarcane mechanization

Evaluation of Bioformulation Applicator using new formulations against white grubs under field condition: A field experiment was planned to evaluate the Bio Formulation Applicator (previously known as EPN applicator) using other biopesticides (Bt) / formulation for the control of white grubs in sugarcane crop. Bt-62 culture multiplied on the standard T3 media in fermentor has been evaluated in white grub endemic area in Sathyamangalam under M/s Bannari Amman Sugars. Two plots of 200 sq. m. each with 7-month-old sugarcane crop were demarcated in a highly grub-infested grower's farm. In each plot, the soil was excavated for about 1 m length and 15 cm depth in the root zone at randomly selected spots, and grub number was counted to represent the pre-treatment assessment of white grub. Bt-62 multiplied on T3 was applied in one plot and an untreated plot was maintained as control. The 20 litre fermentor product with a pre-determined dosage (1.0 x 10^{14} CFUs ha^{-1}) was diluted with 40 L of water and applied using a manually operated bio-formulation applicator near the root zone of the crop. Post-treatment white grub incidence was assessed 30 days after imposing the treatment and the results showed a 56.66% decrease in grub number in the treated plot.

Field evaluation of Bio formulation applicator using the new formulation

(T. Arumuganathan, C. Palaniswami, C. Sankaranarayanan, P. Mahesh-ICAR-SBI, Coimbatore and T. Senthil Kumar, S. Syed Imran - ICAR-CIAE RC, Coimbatore)

Inter-Institutional Collaborative Research Project on testing and evaluation of IISR sugarcane machineries under tropical condition

Fabrication of IISR-Sugarcane cutter planter cum raised bed multicrop seeder: The sugarcane machinery namely the Sugarcane cutter planter cum raised bed multicrop seeder has been fabricated at the workshop in the Division of Agricultural Engineering, ICAR-IISR, Lucknow for testing and evaluation under tropical conditions in Coimbatore during the next planting season. The developed machine is capable of planting two rows of sugarcane in furrows and drilling seeds of the intercrop in the raised beds simultaneously.

Fabricated Sugarcane sett cutter planter- cum- raised bed multi crop seeder

Demonstration of sugarcane sett cutter planter

Demonstration on tractor Operated two-row deep furrow sugarcane cutter planter was conducted for the sugarcane farmers, cane officers, and field staff of M/s. Bannari Amman Sugars (BAS) Limited – Unit V, Thirukoilur at Chennakunam village in Mugaiyur block of Villupuram district on 5 April, 2024. More than a hundred farmers from Villupuram district and more than fifty cane officials from M/s. Bannari Amman Sugars witnessed the demonstration.

Field demonstration of two row sugarcane sett cutter planter at Chennakunam village, Tirukoilur

(A.K. Singh-ICAR-IISR, Lucknow; T. Arumuganathan, S. Anusha-ICAR-SBI, Coimbatore and T. Senthil Kumar, ICAR-CIAE RC, Coimbatore)

Development and promotion of Mini tractor operated sugarcane planters for small-farm mechanization

Field testing and performance evaluation of Mini tractor operated sugarcane sett cutter planter

A field experiment was taken up for field testing and performance evaluation of the newly developed mini tractor-operated sugarcane sett cutter planter at ICAR-SBI, Coimbatore with the two sugarcane variety Co 86032 was used. Two different spacing *viz*., 4 feet (120 cm) and 5 feet (150 cm) were accommodated in the main plot and three planting methods namely Mini tractor-operated sugarcane sett cutter planter method, IISR sugarcane sett cutter planter method and manual sett planting method were allotted in subplots with four replications. At harvest, observations on number of millable canes (NMC), single cane weight and cane yield were recorded. The results revealed that there was no significant difference in cane yield at 120 cm and 150 cm plant spacing and cane planting at 120 cm plant spacing recorded numerically higher cane yield. Machine planting with mini tractor-operated sugarcane planter recorded on par cane yield (126.10 t ha^{-1}) with IISR two row deep furrow sugarcane planter (130.20 t ha^{-1}) and manual two budded sett planting (116.50 t ha^{-1}). Mini tractor-operated sugarcane planter was found useful in saving time and labour.

Working of mini tractor-operated sugarcane sett cutter planter in the field

Field view of the crop raised using mini tractor operated sugarcane sett cutter planter

Field testing and performance evaluation of Mini tractor operated sugarcane settling transplanter

A field experiment was conducted for field testing and performance evaluation of the newly developed mini tractor-operated sugarcane settling transplanter. The field trial was designed with seven planting treatments namely the Mini tractor-operated sugarcane setting transplanter method with the plant-to-plant spacing of 45 and 60 cm, ICAR-SBI-CIAE sugarcane settling transplanter method with plant-to-plant spacing of 45 and 60 cm, manual settling planting method with plant to plant spacing of 45 and 60 cm and farmers practice (sett planting method) as control treatment with three replications. The settlings raised from the sugarcane variety Co 86032 were used as the planting material and the planting was completed in March 2024 and the field trial is in progress.

Working of mini tractor-operated sugarcane settling transplanter

Field view of the crop raised using mini tractor operated sugarcane settling transplanter

(T. Arumuganathan and S. Anusha-ICAR-SBI, Coimbatore; T. Senthil Kumar - ICAR-CIAE RC, Coimbatore)

Natural farming for sustainable use and management of natural resources to improve productivity in sugarcane based cropping system

Trial I – Natural farming (2022-23)

A field trial was taken up during March 2023 to assess the effect of various manures *viz*., FYM, goat manure, and vermicompost in sustaining cane yield compared to conventional farming. The application of Jeevamuruth for supplement nutrients has been done in all the natural farming treatments. The soil was mulched with the sugarcane trash collected initially from harvested fields for controlling weeds and improving soil organic carbon. *Insitu* trash mulching was also done during 6th and 8th months while taking up de-trashing. Higher number of millable canes ('000) and cane yield were recorded with Natural Farming (NF) with cow dung manure @12.5 t ha^{-1} + mulching (83.75 and 157.25 t ha^{-1}) and NF with goat dung manure @12.5 t ha^{-1} + mulching (81.47 and 151.18 t ha^{-1}) and were comparable with conventional farming (131.89 t ha^{-1}). The sucrose percentage and the purity percentage were non-significant among the treatments. However, the CCS% and CCS yield was significantly higher in NF with cow dung manure @12.5 t ha^{-1} + mulching (13.53% and 21.27 t ha^{-1}) and NF with goat dung manure @12.5 t ha^{-1} + mulching (14.06 and 21.27 t/ha) than the conventional farming (13.37 and 17.63 t ha^{-1}).

(P. Geetha, K. Hari and A. Vennila)

Exploring novel microorganisms for sugarcane biomass-based 2G ethanol

Two species of white grubs, sugarcane internode borer and red weevil palm were prospected for gut microflora in order to use them as potential source for cellulose-based biomass degradation especially sugarcane bagasse. This work successfully identified total of 28 morphologically distinct bacterial isolates: 11 isolates from *Holotrichia serrata*, 13 isolates from *Holotrichea consanguinea*, three isolates from *Chilo sacchariphagus*, and 1 isolate from *Rhynchophorus ferrugineus*. Of the 28 bacterial isolates that were studied, sixteen of them showed significant cellulolytic activity. The maximal cellulolytic index values for isolates S4, C9 and I2 were 3.67, 3.25 and 1.00 respectively. C1 isolate exhibited a 71.2% bagasse degradation capacity indicating to use this isolate for further studies.

(K. Hari, G.S. Suresha, B. Singaravelu and P. Govindaraj)

Enhancement of sugarcane productivity and profitability through tillage and weed management practices in tropical India

A field experiment was initiated in March 2024 in split plot design to study the effect of different tillage and various weed management practices on weed dynamics, weed control, growth, and yield of sugarcane. The main plot treatment consists of two tillages practices; conventional tillage and reduced tillage. Sub-plot treatment includes nine weed management practices namely unweeded control, three-hand weeding at 30, 60 and 90 DAP, pre-emergence pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} + brown manuring with daincha *fb* application of metribuzin +2,4-D + pyrazosulfuron ethyl (ready mix) @ 3 kg ha^{-1} after final earthing up, pre-emergence pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} + brown manuring with daincha *fb* trash mulching @ 10 t ha^{-1} *fb* application of metribuzin +2,4-D + pyrazosulfuron ethyl (ready mix) @ 3 kg ha^{-1} after final earthing up, pre-emergence pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} + trash mulching @ 10 t ha^{-1} *fb* application of metribuzin +2,4-D + pyrazosulfuron ethyl (ready mix) @ 3 kg ha^{-1} after final earthing up, pre-emergence pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} + intercropping with black gram *fb* application of metribuzin +2,4-D + pyrazosulfuron ethyl (ready mix) @ 3 kg ha^{-1} after final earthing up, pre-emergence atrazine 50% WP @ 2.5 kg a.i. ha^{-1} *fb* one hand weeding at 60 DAP *fb* 2,4-D application @ 1.0 kg a.i. ha^{-1} after final earthing up, early post-emergence metribuzin 70% WP @ 1.25 kg a.i. ha^{-1} at 10 DAP *fb* one hand weeding at 60 DAP *fb* 2,4-D application @ 1.0 kg a.i. ha^{-1} after final earthing up and pre-emergence pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} + intercropping with black gram *fb* trash mulching @ 10 t ha^{-1} *fb* application of metribuzin +2,4-D + pyrazosulfuron ethyl (ready mix) @ 3 kg ha^{-1} after final earthing up. The soil is moderately alkaline (pH: 8.4) with EC of 0.4 dSm^{-1}. The soil was medium in organic carbon (0.54%) low in available nitrogen (190.8 kg ha^{-1}), medium in available phosphorus (20.9 kg ha^{-1}), and high in available potassium (477.2 kg ha^{-1}). Daincha and Black gram (VBN-11) have been sown as intercrop in four treatments to assess their effect on sugarcane growth and weed control. Weed flora observed in the experimental field were *Trianthema portulacastrum*, *Datura metel*, *Commelina benghalensis*, *Ipomoea* sp., *Corchorus* sp., *Digera arvensis*, *Parthenium hysterophorus*, *Digitaria sanguinalis*, *Dinebra retroflexa*, *Rottboellia cochinchinensis*, *Panicum* sp., *Cynodon dactylon*, *Brachiaria* sp., *Chloris barbata*, *and Cyperus rotundus*. At 180 DAP, the total weed count was higher in conventional tillage (18.3 no. m^{-2}) than in reduced tillage (13.1 no. m^{-2}). Among different weed management treatments, pre-emergence pendimethalin 38.7% CS @ 1.0 kg a.i. ha^{-1} + brown manuring with daincha *fb* trash mulching @ 10 t ha^{-1} *fb* application of metribuzin +2,4-D + pyrazosulfuron ethyl (ready mix) @ 3 kg ha^{-1} after final earthing up recorded lowest weed count of 9.2 no. m^{-2}. Soil temperature under trash mulching was 2-3°C lower than the rest of the treatments. Reduced tillage (18.1%) and mulching treatment (15.9%) retained more soil moisture as compared to conventional tillage (14.5%) and without mulching treatment (13%). The light interception was maximum in the sole sugarcane plot in comparison to sugarcane intercropping. The experiment is in progress.

(S. Anusha, K. Kannan, K. Hari and V. Krishnapriya)

5.2.2 Plant Physiology

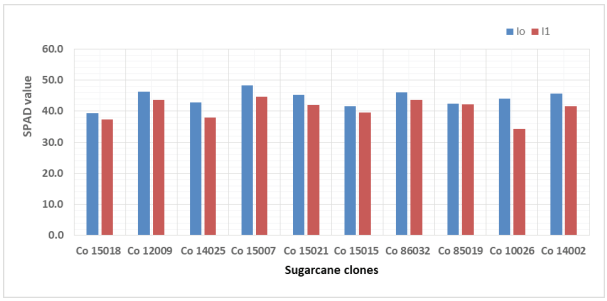
Enhancing physiological efficiency of sugarcane

Evaluation of physiological efficiency of commercial hybrids and species clones of *Saccharum* for water use under water-limited conditions

Ten promising commercial sugarcane (*Saccharum*) hybrids were planted in split-plot design with irrigation treatment as the main plot and sugarcane clones as the subplots, and each treatment was replicated two times and the recommended cultural practices were followed except irrigation. The irrigation treatments included I_o: full irrigation at the recommended interval, with 100% crop evapotranspiration (ET) replacement (control); and I_1: restricted irrigation at the recommended interval, with 50% crop ET replacement (50% by volume). A measured quantum of water was applied according to the treatments, which was monitored frequently using a water meter. Deficit irrigation was initiated at 60 DAP to ensure uniform crop establishment. The quantity of irrigation water applied through furrow in each treatment. Above-ground biomass from an area of one square meter was determined through destructive sampling during the formative and grand growth phases. Canopy temperature and SPAD index, were also recorded to determine the water deficit's impact on sugarcane clones. The weather data during the 2023-24 experimental period showed that the rainfall was comparably better (>750 mm) than the 40-year average rainfall (674 mm), and the irrigation treatments led to significant differences in the recorded physiological parameters, cane yield, IWUE, and water productivity. A significant decline in cane yield was observed under the water deficit (I_1) condition compared to the control (I_o).

Significant variations in leaf, stem, and sheath biomass, leaf number, SPAD index and Canopy temperature were observed under both conditions, and the water deficit tolerant clones exhibited better physiology combined with cane yield. Under deficit condition, the clones *viz.*, Co 14002, Co 14025, and Co 85019 performed well with respect to water productivity. The canopy temperature (CT) of the susceptible clones exhibited a warmer canopy along with reduced physiological processes, while the Co 85019 which possesses deeper roots had a cooler canopy. The CT showed a significant correlation with cane yield.

Experimental field view of the water deficit study in sugarcane

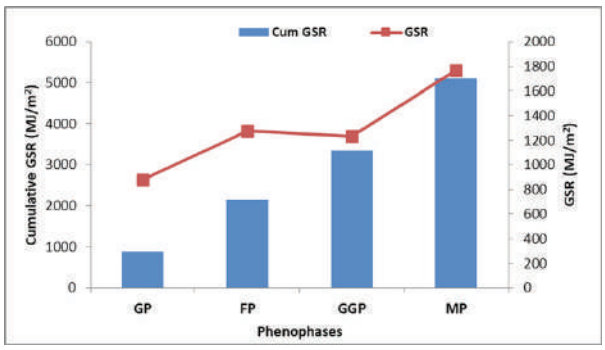


Effect of deficit irrigation on SPAD in sugarcane clones

(R. Arun Kumar, S. Anusha, G. Hemaprabha, V. Krishnapriya, V. Sreenivasa and M. Alagupalamuthirsolai)

Radiation use efficiency of sugarcane genotypes as influenced by water levels and crop geometry

Ten sugarcane clones were conducted in field conditions under irrigation treatments *viz.*, I_0 - Irrigation at 100% cumulative pan evaporation, and I_1-50% reduction in the volume of water irrigated. Controlled irrigation was provided to individual clones and treatment through PVC pipes monitored by the water meter. Irrigation was quantified based on pan evaporation, KC value (crop coefficient depending on the age of crop) and area of plots. The total global radiation received during the experimental period was 5115 MJ m^{-2}. Line quantum sensors (LICOR) along with a digital data logger (LI-1400) were used to record the light interception and light reflection data. The cumulative global photosynthetically active radiation (PAR) recorded during the germination phase, formative phase, grand growth phase, and maturity phase were 423, 1027, 1613, and 2455 MJ/m^2 respectively. The mean, maximum, and minimum daily global solar radiation during the crop period was 335 Cal. $cm^{-2}.d^{-1}$, 476 Cal.$cm^{-2}.d^{-1}$ and 62 Cal.$cm^{-2}.d^{-1}$ respectively. Above-ground biomass from an area of one square meter was determined through destructive sampling during the formative phase and grand growth phase. The weather data during the 2023-24 experimental period showed that the rainfall was comparably better (>750 mm) than the 40-year average rainfall (674 mm), and the irrigation treatments led to significant differences in the recorded crop growth and physiological parameters and finally resulted in declined solar energy utilization efficiency for biomass and stalk productivity. Among the studied clones the Co 85019, Co 14002, and Co 14025, recorded better solar energy utilization efficiency (Eu effy >2.0) under both control and water deficit conditions. Significant variations in leaf, stem, and sheath biomass along with leaf number, SPAD index, and Canopy temperature were observed under both conditions, and the water deficit tolerant clones exhibited better physiology combined with cane yield. Significant variation in biomass, light interception, and shoot population was also recorded. A few clones *viz.*, Co 85019, Co 14002, Co 15021, and Co 14025 recorded with a better light interception, and RUE (Radiation Use Efficiency) under water-limited conditions.



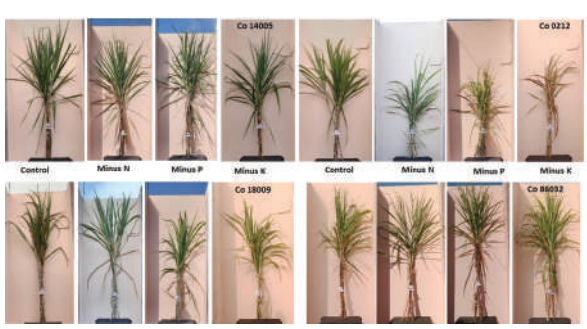
Distribution of global solar radiation (GSR) and cumulative GSR in sugarcane GP: Germination phase, FP: Formative phase, GGP: Grand growth phase, MP: Maturity phase

(R. Arun Kumar and P. Geetha)

Deciphering the physiological basis of nutrient use efficiency in sugarcane

Field evaluation in a strip-plot design was initiated with four main treatment plots (Control: 280:62.5:120 kg ha^{-1} NPK + $ZnSO_4$ 37.5 kg ha^{-1} + $FeSO_4$ 100 kg ha^{-1}, Minus N: 62.5:120 kg ha^{-1} PK + $ZnSO_4$ 37.5 kg ha^{-1} + $FeSO_4$ 100 kg ha^{-1}, Minus P: 280:120 kg ha^{-1} NK + $ZnSO_4$ 37.5 kg ha^{-1} + $FeSO_4$ 100 kg ha^{-1}, Minus K: 280:62.5 kg ha^{-1} NP + $ZnSO_4$ 37.5 kg ha^{-1} + $FeSO_4$ 100 kg ha^{-1}) and twenty-two genotypes in sub-plots (Co 86032, Co 11015, Co 0212, Co 09004, Co 10026, Co 18009, Co 14012, Co 14005, Co 14004, Co 15006, Co 15009, Co 15010, Co 15017, Co 97010, Co 0238, Co 06022, CYM 08-922, GUK 06-402, AS 04-924, AS 04-1875, AS 04-939, AS 06-391-503). Soil pH, EC, organic carbon, available N, available P, and available K prior to planting was 8.4, 496 µS m^{-1}, 0.51%, 149.62 kg ha^{-1}, 13.07 kg ha^{-1} and 596.76 kg ha^{-1}, respectively

The effect of treatment was negligible on cane height, cane girth, number of internodes, single cane weight (SCW) and number of millable canes (NMC), while internode length and cane yield showed significant (α=0.1) variation due to treatment. Nevertheless, genotypic variability and the interactive effect of treatment and genotype were significant (α=0.01) for all the recorded attributes of yield. Averaged over genotypes, cane yield was highest in minus P (84.5 t ha^{-1}), followed by control (84.3 t ha^{-1}), minus N (81.8 t ha^{-1}) and minus K (73.2 t ha^{-1}). Averaged over treatments, cane yield was highest in Co 14012 (118.08 t ha^{-1}), Co 86032 (106.35 t ha^{-1}), Co 14005 (91.85 t ha^{-1}) and Co 18009 (91.59 t ha^{-1}), and least in Co 0238 (50.58 t ha^{-1}) and Co 10026 (56.05 t ha^{-1}). Significantly high tillering observed in the inter-specific hybrids attributed to cane yield on par with that of Co-canes, which was highest in AS 04-1875 (123.84 t ha^{-1}), followed by AS 04-939 (113.44 t ha^{-1}) and AS 04-924 (100.10 t ha^{-1}).



Variability in plant growth of sugarcane varieties in response to low availability of major nutrients under field condition

Juice analysis revealed a significant (α=0.05) effect of treatments on sucrose content in juice (%) and Brix (%), whereas the effect on juice extraction (%), purity, commercial cane sugar (CCS%) was negligible. Averaged over genotypes, sucrose content in juice and Brix was highest in minus P (18.6% and 21.5%) and least in control (18.0% and 20.7%). Averaged over treatments, sucrose content in juice was highest in Co 11015 (21.28%) and Co 15017 (20.38%), while least values were observed in Co 10026 (16.34%). Similarly, Brix was highest in Co 11015 (23.94%) followed by Co 15017 (22.87%), while least values were observed in Co 10026 (19.34%). Irrespective of treatment, among inter-specific hybrids, sucrose content in juice varied between 14.24% (CYM 08-922) and 18.93% (AS 06-391-503), while Brix ranged from 17.44% (CYM 08-922) to 21.58% (AS 06-391-503). Treatment-wise soil analysis revealed significant field heterogeneity, which attributed to the variability in overall plant growth, yield and quality of the tested sugarcane genotypes. Amongst the tested Co-canes, agronomic N use efficiency (ANUE) was higher in Co 14005, Co 14012, Co 0238, Co 15010, Co 97010, Co 18009, and Co 86032; while agronomic P use efficiency (APUE) was highest in Co 14005, Co 14004, Co 15010, Co 10026, and Co 97010. Agronomic K use efficiency (AKUE) was Co 15010, Co 0238, and Co 10026. The germplasm clones AS 06-391-503, AS 04-924 and CYM 08-922 exhibited higher ANUE, APUE and AKUE as compared to the other tested clones.

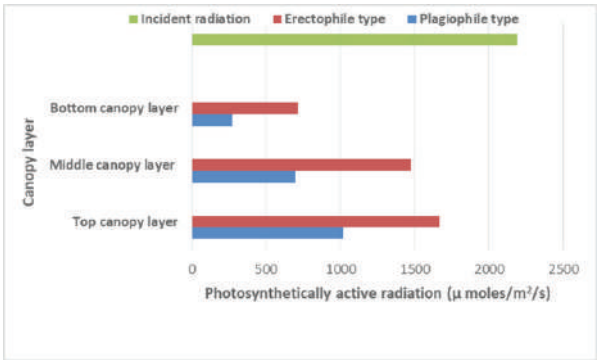
(V. Krishnapriya, R. Arun Kumar, S. Anusha, V. Vinu and M. Alagupalamuthirsolai)

Plant architectural traits for developing ideotype concept in sugarcane for tropical conditions

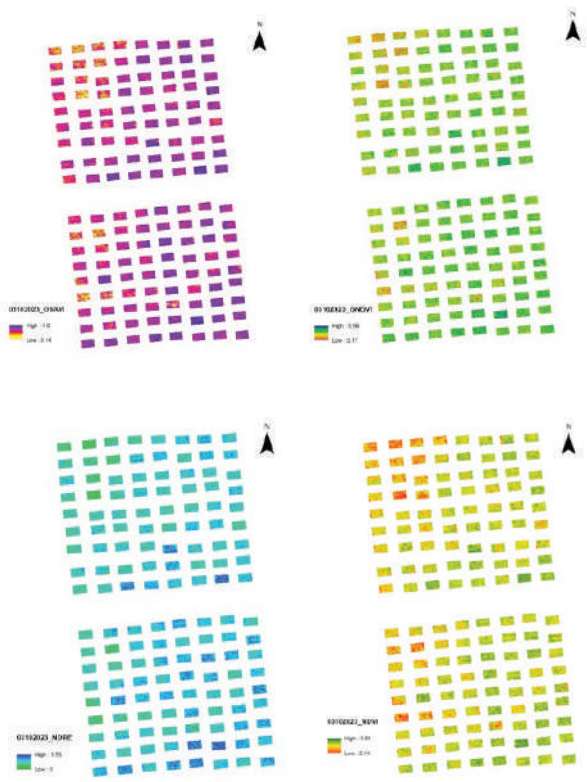
Observations were recorded from two experiments (32+ 38) in seventy genotypes (comprising of Species clones, pre-breeding clones, and commercial types) on physiological (Chlorophyll content, chlorophyll fluorescence (*Fv/Fm*), SPAD index, canopy temperature (CT), leaf angle, canopy cover, growth (shoot height, tiller count, water shoot, leaf, sheath, stem, and dry matter partitioning), juice analysis and yield and yield attributes (NMC, Single cane weight). The mean, minimum, and maximum SPAD index at the early stage in Co canes were 44.3, 38.2 and 49.4, while the mean, minimum, and maximum SPAD index at the later stage were 32.9, 19.0, 40.8, respectively. Significant variations in chlorophyll 'a' and 'b' content were also observed. The canopy temperature showed significant variability among the studied clones. The leaf angle of insertion revealed that the clones with both erect leaves at the

top and the planophile leaves at the bottom layer have an advantage in harvesting solar radiation for effective use of photosynthesis. The mid-point vertical height of the TVD leaf had a positive correlation with cane yield in Co canes. Canopy cover (CC%) at the early stage of the crop specifies the phenomena of early canopy cover developing in certain clones favours effective harvesting of solar radiation, translation in the form of biomass production, and subsequent partitioning towards sink development besides inhibiting the weed growth by shadowing. Considerable variations in CC% were also observed among the studied pre-breeding clones. Distribution of photosynthetically active radiation (PAR) in various canopy layer (Top, middle and bottom) in two different types (erectophile and plagiophile) of sugarcane were recorded.

Crop growth and dry matter partitioning studied at the formative and GGP in the sugarcane clones revealed a better association of source-sink relationship in Co canes, while few clones in the species and pre-breeding types showed vice versa. The clones 2019-8, Co 8371, and Co 12009 were observed with a better harvest index (HI%) of more than 80%. Significant variations in cane yield were observed among the Co canes and pre-breeding and species clones. Among the clones, 14-154 and ISH 111 recorded HI% compared to other studied clones. Significant variations in cane yield were observed among the pre-breeding and species clones. Among the Co canes the Co 11015, 2019-26, 2019-25 were recorded with better sucrose content, while among the pre-breeding and species clones the WL10-40, 98-290 indicated better sucrose. Also, the drone images (both RGB and multispectral images) were recorded at the grand growth phase, and few indices have been identified to associate with chlorophyll content, biomass and cane yield. The sugarcane clone *viz*, Co 85019, Co 2019-44, Co 17004 was recorded with a better photosynthetic rate compared to other Co canes, and this signifies the efficient carbon metabolism, growth and biomass in the identified clones. Among the studied traits the total dry matter, cane volume, NMC, plant height, chlorophyll fluorescence, germination % showed significant positive correlation with cane yield in Co canes and germplasm clones. The calculated cane volume was found to have a significant positive correlation with cane yield and the clones with better harvest index had greater cane volume.



Distribution of photosynthetically active radiation (PAR) in various canopy layer (Top, middle and bottom) in two different types (erectophile and plagiophile) of sugarcane

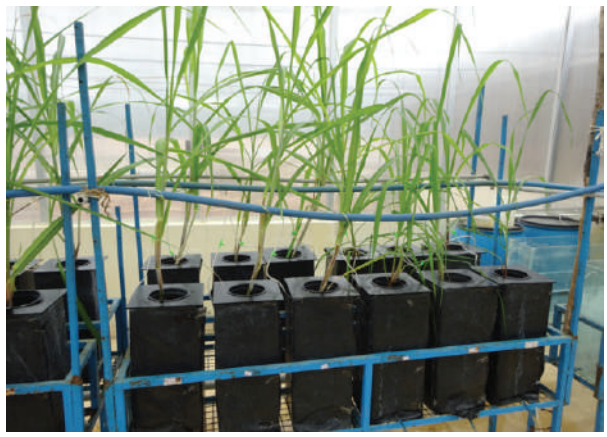


The drone images (both RGB and multispectral images) at the grand growth phase, and a few indices (OSAVI, GNDVI, NDRE and NDVI).

(R. Arun Kumar, G. Hemaprabha, S. Alarmelu, K. Mohanraj, T. Arumuganathan, V. Sreenivasa, V. Krishnapriya, S. Anusha and M. Alagupalamuthirsolai)

Development of hydroponic screening methodologies for sugarcane varietal evaluation in response to abiotic stress under controlled condition

Hydroponic screening methodology was developed to screen sugarcane crops for drought, salinity and waterlogging tolerant under controlled conditions. Based on our experiment, we found that EC of 8 dS m^{-1} salinity and polyethylene glycol (PEG) can be used for screening salinity-tolerant and water deficit/drought tolerant sugarcane clones respectively under controlled condition. Sugarcane clones *viz*., Co 85019, and Co 86032 were planted in plastic trays, and well-established plants were shifted to hydroponic culture condition (Tank size: LxBxH=20x20x50cm) and Hoagland solution (Major nutrient: Ca $(NO_3)2.4H_2O$, KNO_3, $MgSO_4.6H_2O$, KH_2PO_4, Fe EDTA, Minor nutrient: H_3BO_3 $MnCl_2.4H_2O$ $ZnSO_4.7H_2O$ $CuSO_4.5H_2O$ (NH_4) $6MO_7O_{24}$ $4H_2O$ were used for nutrient supply and maintenance of crop. Initially the solution concentration was given half strength, and gradually the strength was increased as the growth progressed. The hourly temperature and relative humidity were recorded inside the chambers by sensors and datalogger. Sugarcane is a moderately tolerant crop to salinity and the clones were subjected to salinity stress by treating hydroponically grown plants to 8 dS m^{-1} salt (mixture of salts) stress which led to salt stress after 15 days of treatment. Salt stress has induced a significant decline in the estimated chlorophyll content in the studied sugarcane clones. Non-significant decline in the SPAD at the top most leaves (canopy layers), while the bottom leaves showed a significant decline in the SPAD index, indicating the more loss/deterioration of chlorophyll molecules in the bottom leaves of susceptible clones compared to the tolerant clone. The chlorophyll fluorescence (*Fv/Fm*) revealed that there was a significant decline in photochemical efficiency under salt stress conditions. Significant differences in the nitrate reductase activity were observed under salt stress and waterlogging. The blocking of aeration to the hydroponic solution has led to waterlogging (WL) stress, and it has also led significant decline in oxidation reduction potential (redox potential) of water. The stored Hoagland solution was filled in the tank for the WL stress. The WL stress has resulted in increased side tillers compared to control and salt stressed sugarcane clones.

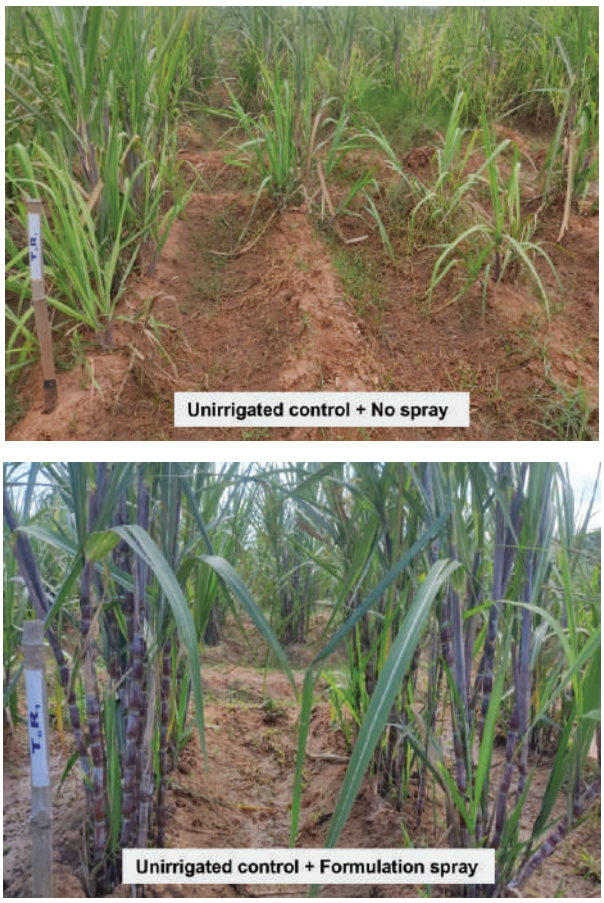


Sugarcane crop under hydroponic condition

(R. Arun Kumar, V. Krishnapriya, K. Hari and M. Alagupalamuthirsolai)

Development of foliar spray formulation to mitigate water deficit stress in sugarcane

Foliar spray formulations have been developed for water deficit alleviation in sugarcane. To test the efficacy of formulation, a field experiment was initiated with two varieties *viz*., Co 86032 and Co 11015. Control plots were irrigated as per the recommended irrigation schedule and treatment plots were kept under unirrigated conditions during the formative phase 90 to 160 DAP (Critical period for sugarcane). During the experimentation period, the crop faced severe atmospheric drought that has been reflected in the water deficit field with no foliar spray treatment. This was negatively reflected in growth, physiological, and biochemical traits in untreated plants. However, few of the growth formulation treatments showed a positive response of maintaining better membrane stability, photosynthetic pigments, and compatible osmolytes, like proline content, phenolic content, starch, soluble protein content, and antioxidant enzymes in leaves during the formative phase, which leads to maintaining better leaf and stalk biomass during the grand growth and harvest stages. The efficacy of these formulations showed a significant increase in the number of millable cane, cane weight under unirrigated conditions at harvest.



Effect of foliar spray formulation in alleviating water deficit stress in sugarcane

(M. Alagupalamuthirsolai, R. Gomathi, R. Arun kumar and V. Krishnapriya)

5.2.3 Soil Science and Agricultural Chemistry

Natural resource management for enhancing productivity and sustainable sugarcane production

Demonstration of settling transplanting technology for sugarcane

Sugarcane Settling Transplanting Technology (STT) was evaluated and demonstrated in Alfisol during 2017-2023 and needs to be evaluated and demonstrated in Vertisols also. Sub-surface drip irrigation - fertigation facilities were created in a Vertisol and prepared the settlings of single bud setts of Co 11015, Co 18009 and Co 86032 treated with nutrients and pesticides using a mechanized Sett Treatment Device. The settlings were transplanted at 1.5 m x 0.6 m spacing. Based on the initial available nutrients in the soil, Soil Test Crop Response -based nutrient dose for the target yield of 150 t ha^{-1} was applied. Simultaneously, conventional cultivation was also undertaken with two-budded setts at 0.9 m row spacing under furrow irrigation. The settling establishment was 95% in STT. Germination in conventional planting was 55%. The black gram (VBN 11) as intercrop was taken up and harvested 70 days after sowing which yielded 589 kg ha^{-1}. Earthling up was carried out using mini-Tractor operated implement at 100 DATP. NMC at 240 DATP was higher in conventional method (from 86914 to 102840 ha^{-1}) over STT (71116 to 91467). The crop was harvested in the first week of August 2024. However, Single cane weight at harvest showed a distinct difference between the STT and the conventional method in Vertisols. Among the varieties, Co 11015 had the highest single cane weight (1.97 kg) followed by Co 18009 (1.88 kg) and Co 86032 (1.81 kg) in STT while in conventional practice, it was 1.48, 1.55 and 1.51 kg respectively. The cane yield of 165.5, 158.4 and 133.7 t ha^{-1} was recorded by Co 86032, Co 11015 and Co 18009, respectively in STT while in conventional method the yield was 155.3, 151.8 and 134.7 t ha^{-1}, respectively. The sugar yield ranged from 18.5 (Co 18009) to 23.6 (Co 11015) t ha^{-1}. In total 57.03 tonnes of cane was supplied to the factory from the experimental area of 3708 m^2 with the productivity of 151.58 t ha^{-1}.

(A. Vennila, S. Anusha, C. Palaniswami, V. Kasthuri Thilagam and P. Malathi)

SoSmart software: A Soil smart sugarcane management system software was developed with site specific nutrient and irrigation management for sugarcane. This software provides the user with site specific management options for efficient use of inputs based on soil types, climate, variety, planting material, irrigation methods, fertilizer application methods, intercultural operations under sole/intercropped situations, *etc*. The time and quantity of fertilizers and irrigation water to be applied also incorporated in this software on scientific basis. The output serves as a ready reckoner for the users with actual date of executing different management measures. Sugarcane farmers, cane official and extension personnel can make use of this software.

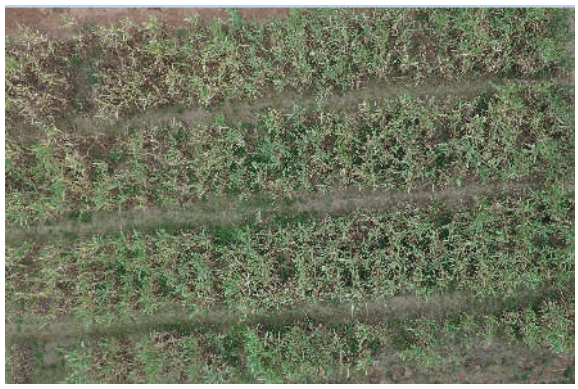
(C. Palaniswami, A. Vennila, and V. Kasthuri Thilagam)

Diagnosis of nutrient deficiencies and diseases, characterization of canopy and estimation of biomass in sugarcane using drone based optical images

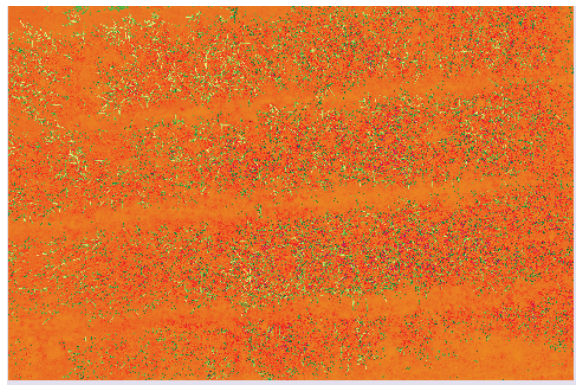
RGB optical images of the crop filed was captured using drone. The drone optical images were stitched and orthomap were prepared. The necessary datasets are

prepared for further analysis. Drone cameras record images as individual pixels recording the intensity of red (R), green (G), and blue (B) The RGB color component of the digital image has 256 levels. A program was developed in C# Visual Studio 2017 to extract red, green, and blue (RGB) features and compute color indices from digital images. The sugarcane crop field was segmented from soil backgrounds to characterize the crop color and to calculate canopy cover (CC), Digital values of RGB, normalized RGB values, normalized difference index -NDI, Hue and saturation (SAT)and Intensity (INT)

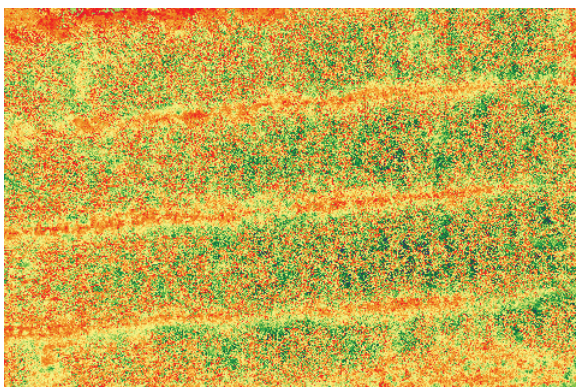
Biomass showed significant correlations with canopy cover (CC) and more than 6 color indices except G and INT values in the segmented dataset and color indices except G value in the non-segmented dataset. CC derived from digital image analysis revealed very high positive correlations of r=0.82*** with biomass and NDI values among color indices showed relatively high correlation with biomass. Biomass was highly correlated with saturation value of color indices in background segmented (r = −0.88**) and non-segmented dataset (r = −0.62**).



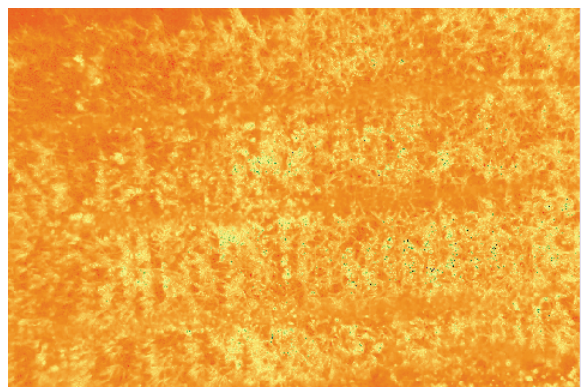
Drone RGB image



SAT value image



INT value image



NDI value image

(C. Palaniswami, A. Vennila, V. Kasthuri Thilagam, T. Arumuganathan, A. Anna Durai, K. Mohanraj, G. Hemaprabha and R. Arun Kumar-ICAR-SBI, Coimbatore; R. Raja-ICAR-CICR Research Centre, Coimbatore)

Evaluation of hydraulic characteristics of waterlogged soil under sugarcane cultivation for deriving suitable management strategies

Two soil profiles were excavated from the sugarcane growing fields of Thiruvannamalai district, Tamil Nadu, for characterization. The profile locations were selected to represent waterlogging and well drained soil conditions in the same topographic sequence to understand the soil characters that cause waterlogging. The soil profile was excavated up to 144 cm and beyond that the water seepage was there. However, the depth of the soil profile was more than 144cm.

Soil profile locations at Thiruvannamalai district

Waterlogged soil profile and their characters

Waterlogged soil profile	Soil depth	Characteristics
	0-30 cm	Clear smooth boundary, clay loam texture, Dark grey colour, mottling absent; strong grade angular blocky structure; few very fine pores, thin patchy clay cutans; strongly calcareous, many fine roots present, salt encrustation found in surface
	30-72 cm	Clear wavy boundary, clay loam texture, grey colour, strong angular blocky type structure; thin patchy clay cutans; strongly calcareous, few very fine pores; few fine roots
	72-115 cm	Gradual and wavy boundary, loamy sand, Greyish brown colour, patchy clay cutans, few fine roots; slightly calcareous, few very fine pores
	115-144 cm	Gradual and wavy boundary, clay loam texture, Greyish brown colour, crumb structure; No cutans; strongly calcareous, few very fine pores; No roots
	> 144 cm	Gradual and wavy boundary, clay loam texture, Greyish brown colour, granular structure, No cutans, strongly calcareous, No roots

Chemical and hydraulic characteristics of waterlogged soil profile

Soil Depth (cm)	pH	O.C. (%)	Total N (%)	Total P (%)	Total K (%)	CEC (cmol(+)/kg)	Bulk density (Mg m^{-3})	Hydraulic conductivity (cm hr^{-1})
0-30	8.24	0.75	0.09	0.03	0.17	15.7	1.62	1.87
30-72	8.21	0.42	0.09	0.02	0.15	10.4	1.68	1.75
72-115	8.24	0.23	0.09	0.01	0.10	8.7	1.82	0.18
115-144	8.31	0.22	0.07	0.01	0.11	11.6	1.81	0.14
> 144 cm	8.36	0.27	0.07	0.02	0.11	11.6	-	-

The pH of the surface soil is 8.24 and increased with depth up to 8.36 and belongs to Alkaline category. Soil organic carbon content was high in the topsoil and decreased with depth. Total N, P, K and CEC are also in the same decreasing trend with soil depth. The Bulk density of the topsoil is 1.62 to 1.81 Mgm^{-3} in the lower depths. The hydraulic conductivity is moderately slow in topsoil (1.87 cm hr^{-1}) and decreased to the slow category (0.14 cm hr^{-1}) in the lower depths indicating the soil drainage is very poor in this profile and causing waterlogging. The soil colour of the waterlogged profile is grey to brownish from top to bottom indicating the increased colour intensity. The soil texture was clay loam in the top and the clay content gradually increased at the bottom. As the soil is in the low-lying area clay deposition was high in the surface and causing the drainage problems. The soil is calcareous in nature.

Characteristics of the drained soil profile

The soil profile in the well drained location also characterized for hydraulic and other properties. The soil is non calcareous with red in colour. The soil has comparatively high sand content that indicates the transportation of clay particles from higher elevation to lower elevation.

Drained soil profile and their characters

Drained soil profile	Soil depth	Characteristics
	0-19 cm	Clear smooth boundary, mottling absent; Granular structure; cutans absent; micro pores; few fine roots, coarse fragments: 8.3%; No calcareousness
	19-53 cm	Clear wavy boundary, mottling absent; thin patchy cutans; many Micro size pores; Granular structure, Few fine roots, No calcareousness
	53-72 cm	Clear wavy boundary, mottling absent; cutans absent; many Micro size pores; Few fine roots, No calcareousness
	72-90 cm	Clear wavy boundary, mottling absent; cutans absent; many Micro size pores; no roots, No calcareousness
	>90 cm	Feldspar parent material

Chemical and hydraulic characteristics of drained soil profile

Soil Depth (cm)	pH	O.C. (%)	Total N (%)	Total P (%)	Total K (%)	CEC (cmol(+) /kg)	Bulk density (Mg m^{-3})	Hydraulic conductivity (cm hr^{-1})
0-19	7.19	0.37	0.07	0.02	0.18	8.7	1.28	11.7
19-53	7.13	0.29	0.07	0.01	0.26	6.8	1.28	7.0
52- 72	7.50	0.11	0.05	0.01	0.56	7.1	1.65	5.8
72-90	7.64	0.19	0.05	0.01	0.51	4.6	1.59	4.8
> 90	7.67	0.18	0.05	0.01	0.32	4.7	-	-

The soil pH increased with depth and has slight alkalinity. Organic carbon content in the soil is also comparatively low due to soil erosion. Soil bulk density is normal and the hydraulic conductivity was high in top soil and decreased with depth.

(V. Kasthuri Thilagam, A. Vennila and C. Palaniswami)

Optimisation of phosphorus nutrition, organic amendments, and crop geometry for improving sugarcane productivity in calcareous soil

The experiment is planned Split-split plot design with organic amendments (FYM and Daincha) as main-plot, crop geometry (0.900 and 0.675 m^2) as subplot and P treatments as sub-sub plot (T1-T6 with varying time and source of P). The initial soil analysis revealed calcareousness and then the Daincha @ 20 kg ha^{-1} was sown in one of the main plots and incorporated after 50% flowering and FYM @12.5 t ha^{-1} was broadcasted in the other main-plot before last ploughing. The row spacing was kept as 1.5 m. Nutrient dose was calculated as per Soil Test Crop Response approach for the target yield of 150 t ha^{-1}. Basal dose was applied as per the treatment plan. Single bud setts of the variety, Co 11015 were treated with nutrients and pesticides using Sett Treatment Device and prepared the settlings in portrays. Gypsum @ 2.5 t ha^{-1} was applied in all the plots. The transplanting was taken up as per crop geometry treatment. Tiller initiation percent (early tillering) was recorded at 30 DATP and found significant differences in organic amendments, crop geometry and P treatments and the interaction organic amendments and P treatments. FYM showed significantly higher tiller initiation percent than Daincha at 30 DATP. Wider spacing (0.6 m Settling to Settling) showed significantly higher tiller initiation percent than closer spacing (0.45 m Settling to Settling) at 30 DATP. The P treatment, T4 (50% DAP at Basal and 50% DAP at 90 DATP was at par with T5 (50% SSP (Basal) + Urea N equivalent to 50% DAP at Basal + 50% DAP at 90 DATP) and significantly higher than all other treatments. Among the interactions, FYM + T5 was at par with FYM +T4 and Daincha + T4 and significantly higher than all other combinations.

(A. Vennila, V. Kasthuri Thilagam and C. Palaniswami)

Multi-disciplinary Projects

Value addition and product diversification in sugarcane

Development of technologies for value-added products from sugarcane

Comparative study on the effect of microwave heating on chemically preserved sugarcane juice

Sample treated with potassium metabisulphite along with microwave heating at a concentration of 200 ppm and 400 ppm and potassium sorbate having a concentration of 0.1%, 0.15%, is found to be more acceptable for storage of sugarcane juice under room temperature. The citric acid reduces the pH of sugarcane juice to 3.56 which has given preservative action and inhibit the growth of micro-organisms during storage. Potassium metabisulphite is found to be excellent in reducing microbial activity during the period of storage. Whereas potassium sorbate able to preserve the flavor without imparting any off flavors. Juice samples without microwave heating have a fermented flavor.

Development of minimal process for preparation of candy from fruit / rind and sugarcane juice

Sugarcane juice-based candy was found to be the best in terms of sensory evaluation and improving the nutrition composition of candy compared to sugar-based candy. Dehydrated fruit and rind candy prepared with base ingredients like sugarcane juice, watermelon, orange peel, and pineapple were found to be acceptable in quality with calorific values. The treatment having watermelon rind, 70°Brix cane syrup using vacuum drier (Ta1) and watermelon rind with 0.1% citric acid using vacuum drier (Ta5) were found to be good. These products exhibited moisture, water activity, ash, pH, protein, reducing sugar, total sugar, phenols, antioxidant, and energy values in the range of 2.64 to 7.3%, 0.45-0.40 aW,1.67 to 1.94%, 3.32 and 3.13, 2.14 and 2.22%,0.13 and 0.56%, 1.16 and 1.36% and 76.81 and 91.36% and 3603 and 3407 cal g^{-1}, respectively. Whereas, orange peel candy with 70°Brix cane syrup and 0.1% citric acid as separate treatments had moisture content of 6.96 and 4.73%, water activity of 0.45 and 0.55 aW, ash content of 1.41 and 1.23%, pH of 3.17 and 3.81, titratable acidity of 1.16 and 1.36%, protein content of 1.94 and 2.46%, reducing sugars content of 0.55 and 0.59%, total sugar content of 80.18 and 77.85%, phenolic content of 8.80 and 7.76 µg ml^{-1}, antioxidant activity of 66.26 and 69.06% and energy value 2077 cal g^{-1}. Pineapple candy composed of moisture (7.10%), water activity (0.44Aw), ash (1.63%80.), pH (3.84), acidity (1.16), protein (2.26%), reducing sugar (0.08), total sugar (87.76%), phenols (5.81), antioxidants (58.81 µg ml^{-1}) and energy values (3011 and 3001 cal g^{-1}).

Sugarcane juice-based toffee and caramel candy: physicochemical and sensory analysis

Toffee and caramel candy made from sugarcane juice with the addition of ingredients make it a value-added product. Toffee made with 85 g butter in 1000 ml of sugarcane juice at optimized temperature of 150°C was found to be in standard and stable form. Similarly, Caramel candy made with 20 g butter and 120 g whipping cream in 1000 ml sugarcane juice at 120°C was the stable product.

Development of process for the preparation of jelly and burfi from sugarcane juice

Jelly prepared with base ingredient sugarcane juice was found to be acceptable quality with good energy value. Jelly made with 0.9% pectin and 0.17% citric acid was found to be standard and stable form. No microbial contamination was found in the samples at room temperature by microbial analysis. Hardness and stickiness was also found good. Burfi prepared with little millet powder and sugarcane juice was found to be more acceptable according to texture and flavor evaluation, and microbial growth was not found. Little millets have high nutrients, gluten-free, low glycemic index and ability to reduce lactose intolerance. In wheat burfi, treatment with 100 ml sugarcane juice had high nutritional values as well as overall acceptability. Desiccated coconut burfi found to be acceptable which is rich in healthy saturated fats with no cholesterol and is a good source of dietary fibre. The wheat and little millet burfi had a shelf life of 60 days at 25°C and desiccated coconut burfi had 35 days at 4°C (refrigerated condition) while marketed burfi had shelf life of 6 or 7 days.

Assessing the quality of sugarcane jam blended with different fruit pulp

Jam prepared with base ingredient sugarcane juice and fruit pulp were found to be acceptable quality with good energy value. Comparative analysis of various fruit pulp blended treatments revealed that jam prepared with sugarcane juice blended with pulp extracted form grape (1:1 sugarcane juice and grape pulp; 0.8% pectin, 0.065% citric acid and 0.013% sodium benzoate), apple (5:1 sugarcane juice and apple pulp; 0.8% pectin, 0.06% citric acid and 0.012% sodium benzoate), strawberry (4:1 sugarcane juice and strawberry pulp; 0.9% pectin, 0.06% citric acid and 0.012% sodium benzoate), pineapple (5:1 sugarcane juice and pineapple pulp; 0.9% pectin, 0.06% citric acid and 0.012% sodium benzoate) and papaya (5:1 sugarcane juice and papaya pulp; 0.7% pectin, 0.06% citric acid and 0.012% sodium benzoate) have scored highest in sensory analysis. No contamination was found in the samples at room temperature.

Exploring new process for preparation of sugarcane juice syrup through clarification

Exploring new techniques for making clarified syrup from sugarcane juice have a large potential. In this study we employed different clarifying agents for the syrub quality . The best result was obtained from the treatment using 6% Calcium bentonite clay, 4 grams sago and egg albumin. The use of different clarifying agents has stabilized the pH of clarified juice around 4.5 to 5.0, titratable acidity of 0.28% to 0.47%, moisture content of 13.5% to 18.06% and the water activity of 0.8 aW. The TSS and viscosity of the product were 68°Brix and 481-217 Pa.s respectively. The total sugar content was 23.0% - 31.0%. It is concluded that good quality clarified syrup had a setting point at 68°Brix. This product can be used in ice cream, candies and many confectioneries.

Comparative analysis of jaggery quality collected from different geographical locations in India

In this study, we analyzed physico-chemical characteristics of jaggery samples collected from different geographical locations in India. The samples namely Marayur jaggery; Salem jaggery; Thirupathur jaggery; Erode jaggery 1; Erode jaggery 2; Erode jaggery 3; Erode jaggery 4; Erode jaggery 5; Erode jaggery 6; Erode jaggery 7; Erode jaggery 8; Erode jaggery 9; Iniya jaggery1 and 2 from ICAR-Sugarcane Breeding Institute, Coimbatore; Udangudi jaggery and UP jaggery were purchased from the market and used for the analysis. Physico-chemical analysis of jaggery samples revealed significant variation in the quality characteristics indicating the possibility of adulteration in the products. The moisture content of samples varied from 0.91%-4.16% where one of the jaggery sample collected from Erode had the less moisture (0.19%) compared to rest of the samples. Thirupathur jaggery had the highest moisture content of 4.16%. Significant variation in the water activity (0.393-0.716 aw) was observed among the samples. pH of jaggery samples was ranged from 5.31-6.93. Salem jaggery showed least ash content of around 0.5% whereas Iniya jaggery recorded highest ash content of 4.0%. significant variation in the total sugar content was observed with the highest sugar content of 91.22% in one of the Erode jaggery sample whereas lowest sugar content of 82.33% was recorded in another sample from Erode. Calorific values of jaggery samples varied 400 kcal per 100 grams of sample.

(G.S. Suresha, K. Hari and P. Murali)

Functional analysis of bioactive compounds from stem extracts of red-fleshed *Saccharum robustum* genotypes for therapeutic applications and their product development

Continuous extraction of bioactive compounds from the stem of red flesh *Saccharum robustum* genotypes was carryout and the same was freeze dried to accumulate more quantity of the powder for carrying out animal studies. Stem extract was subjected to different organic solvent extraction and fractions were isolated for spectral analysis using FT-IR, NMR and LC-MS. Different

fractions were characterized through FT-IR, NMR and LC-MS was carried out. Preliminarily freeze-dried stem extract was analyzed for *in-vitro* α–amylase inhibitor and α–glucosidase activities and found significant bioactivity of stem extract indicating the therapeutic role. However, study of *in-vivo* bioactivity of these compounds would give detailed information on functional role of this product.

(G.S. Suresha, K. Hari, M. Nisha and R.T. Maruthi)

All India Coordinated Research Project (Sugarcane)

Agronomic performance of elite sugarcane genotypes

Agronomic performance of fifteen elite sugarcane genotypes Co 17001, Co 17002, Co 17003, Co 17004, Co 17005, Co 17010, Co 17012, Co 17013, CoVC 17061, CoN 17072, MS 17082, CoT 17366 were assessed with three standard checks *i.e.*, Co 86032 Co 09004, and CoC 671 under two fertilizer levels i.e. 100 and 125 % RDF. The experiment was planted in wide row spacing (150 cm).

Sugarcane cane yield was influenced significantly due to different genotypes wherein, sugarcane genotypes, Co 17004 (180.10 t ha^{-1}) and CoVC 7061 (170.2 t ha^{-1}) followed by Co 17001 (163.22 t ha^{-1}) have recorded significantly higher cane yield than the standard checks Co 86032 (156.85 t ha^{-1}), Co 09004 (155.90 t ha^{-1}) and CoC 671 (138.88 t ha^{-1}). Juice quality (Brix, sucrose, purity, and CCS %) were not influenced significantly by fertilizer levels; however, juice Sucrose%, Purity% and CCS% at harvest showed significant varietal differences. The CCS yield was significantly higher with Co 17004 (27.05 t ha^{-1}), Co 17001 (26.34 t ha^{-1}), CoVC 7061 (21.51 t ha^{-1}) when compared to the standard check of Co 86032 (21.54 t ha^{-1}), Co 09004 (24.69 t ha^{-1}) and CoC 671 (21.01 t ha^{-1}).

Yield attributes as influenced by fertilizer levels and elite genotypes (2023-24)

Treatments	SCW (kg)	NMC (x 10^3)	Cane Yield (t ha^{-1})	Sucrose %	Purity %	CCS %	CCS Yield t ha^{-1}
Fertilizer level							
125% RDF	1.76	95.78	160.9	20.00	90.51	14.01	22.55
100 % RDF	1.34	91.42	147.5	19.84	89.61	13.89	20.49
SED	0.02	2.32	2.20	0.24	0.64	0.25	0.58
CD	NS	NS	4.41	0.35	NS	NS	1.17
Genotypes							
Co 17001	1.70	96.01	163.2	22.35	90.83	16.14	26.34
Co 17002	1.53	113.9	174.3	20.14	90.01	14.03	24.45
Co 17003	1.49	106.7	159.0	21.32	91.60	15.06	23.94
Co 17004	1.62	106.6	180.1	21.30	91.06	15.03	27.05
Co 17005	1.77	80.34	142.2	20.34	89.10	14.08	20.01
Co 17010	1.33	108.4	144.2	20.86	90.29	14.65	21.13
Co 17012	1.40	115.1	161.1	14.74	87.69	10.04	16.17
Co 17013	1.59	107.6	171.0	19.44	89.36	13.78	23.56
CoVC 7061	1.39	125.3	170.2	18.24	89.85	12.64	21.51
CoN 17072	1.45	92.48	134.1	19.17	89.57	13.43	18.01
CoT 17366	1.48	96.08	142.2	18.70	90.53	12.94	18.40
MS 17082	1.50	105.1	157.7	18.58	90.27	12.82	20.22

Treatments	SCW (kg)	NMC (x 10^3)	Cane Yield (t ha^{-1})	Sucrose %	Purity %	CCS %	CCS Yield t ha^{-1}
Co 86032	2.03	77.24	156.8	19.51	89.52	13.72	21.54
Co 09004	1.45	107.8	155.9	22.51	89.58	15.84	24.69
CoC 671	1.69	82.19	138.8	21.69	90.63	15.13	21.01
SED	0.15	3.79	5.10	0.73	1.44	0.57	1.02
CD	0.30	7.62	10.3	1.51	2.90	1.17	2.05

(K. Kannan, P. Geetha, S. Anusha, C. Palaniswami and G. Hemaprabha)

Evaluating the efficacy of Potassium Salt of Active Phosphate (PSAP) for enhancement of sugarcane growth, yield quality

The influence of the application of PSAP with various concentration methods and duration on sugarcane was studied. The influence of PSAP-based nutrient management on yield and yield attributes was found non-significant among the treatments. However, PSAP-based nutrient management in ratoon sugarcane crop showed higher cane yield (88.43 t ha^{-1}) with sett soaking @ 0.8% PSAP solution + RDN, 50% P and 50% K + foliar spray of PSAP @ 0.4, 0.65, 1.10 and 1.10 during 60, 80, 100 and 120 DAP with compared to Recommended dose of fertilizer (RDF) (86.47 t ha^{-1}). The quality parameters such as Brix%, Sucrose%, Purity and CCS% did not vary due to the application of PSAP. However the high CCS yield (11.12 t ha^{-1}) was recorded with sett soaking @ 0.8% PSAP solution + RDN, 50% P and 50% K + foliar spray of PSAP @ 0.4, 0.65, 1.10 and 1.10 during 60, 80, 100 and 120 DAP.

Yield and yield attributes as influenced by PSAP in ratoon crop (2023-24)

Treatments	NMC (x 10^3)	SCW (kg)	Cane Yield (t ha^{-1})	Sucrose %	Purity %	CCS %	CCS Yield (t ha^{-1})
T1	78.98	1.10	86.47	18.21	18.21	12.59	10.90
T2	63.33	0.98	62.87	18.03	18.03	12.44	7.84
T3	65.93	1.02	67.37	17.84	17.84	12.24	9.68
T4	76.39	1.13	87.03	17.99	17.99	12.36	10.92
T5	70.74	0.88	61.67	17.92	17.92	12.33	7.64
T6	67.32	0.92	62.67	18.27	18.27	12.42	7.77
T7	73.15	1.09	79.60	17.63	17.63	12.10	9.64
T8	65.83	1.12	73.40	17.99	17.99	12.38	9.08
T9	75.74	0.95	72.23	17.83	17.83	12.22	8.84
T10	80.39	1.10	88.43	18.61	18.61	12.70	11.12
SEd (p=0.05)	5.25	0.11	11.19	0.58	1.55	0.43	1.49
CD	10.12	NS	22.31	NS	NS	NS	2.12

RDF: *Recommended dose of fertilizers*, **WSS**: *Without sett soaking*, **SS**: *Sett soaking* **FS**: *Foliar spray*

(P. Geetha and S. Anusha)

Evaluation of new herbicide molecules for weed management in sugarcane plant crop

The major weed flora observed in field were *Cyperus rotundus*, *Boerhavia erecta*, *Trianthema portulacastrum*, *Commelina benghalensis*, *Parthenium hysterophorus*, *Brachiaria reptans*, *Digera muricata* and *Cyanadon dactylon*. The weed control efficiency was higher in the pre-emergence application of Clomazone 30% + Sulfentrazone 28% WP (ready mix) 2.5 kg ha^{-1} followed by one inter-cultivation at 60 days after planting (partial earthing up) (72.36%). Clomazone 30% + Sulfentrazone 28% WP (ready mix) 2.5 kg ha^{-1} followed by one inter-cultivation at 60 days after planting (partial earthing up), has recorded the highest cane yield of 93.52 t ha^{-1} which was on par with post-emergence application of Topramezone + Atrazine (ready mix) 3 L ha^{-1} at 2-4 leaf stage of weeds followed by earthing up at 120 DAP.

(K. Kannan, P. Geetha and S. Anusha)

Screening of AVT clones for drought tolerance

Seven AVT clones pertaining to the 18 series were planted in strip plot design along with tolerant standards (Co 99004 and Co 86032) and 7 AVT clones from the 19 series were planted for multiplication. Various physiological data were recorded, and due to severe *pokkah boeng* infection, the data is reserved for verification. The same AVT 18 series were replanted in additional land in strip plot design along with tolerant standards (Co 99004 and Co 86032) for confirming the data. The present crop is being observed with proper growth and drought stress was imposed during the formative phase. A significant decline in shoot count and plant height was observed under drought stress compared to the control condition. Significantly higher canopy temperature was observed in all sugarcane clones under drought stress. Significant variation for the clones was observed in both control and drought conditions. The work is in progress as per the schedule. Based on cane yield and sugar yield the rating has been done and the Co 18002 and Co 18003 are rated as tolerant (T), while Co 18009, Co 18013 and Co 18024 are rated as moderately tolerant (MT) and Co 18001 and Co 18012 are rated as susceptible (S) to drought stress.

(R. Gomathi, R. Arun Kumar and V. Krishnapriya)

Screening of AVT clones for salinity tolerance

Presently seven of 19 series and seven clones of 18 series along with standard checks were planted in microplot. The present crop is being observed with proper growth and salts *viz*., NaCl: $CaCl_2$: Na_2SO_4 in the ratio of 2:2:1 was prepared and salinized water was irrigated at recommended intervals. Significant declines in plant height, NMC, and leaf number were observed under saline conditions. More than a 30% reduction in leaf number and plant height was observed in 19 sugarcane clones grown under salt stress in microplate conditions. Among the sugarcane clones the Co 18002, Co 18003, Co 18009, and Co 19008 showed with better morpho-physiological traits compared to other studied clones.

Control **Treatment**

Sugarcane crop in microplots of ICAR-SBI, Coimbatore

(R. Arun Kumar, V. Krishnapriya and M. Alagupalamuthirsolai)

Nutrient uptake and nutrient use efficiency

Eight clones of AVT plant crop (Co 17001, Co 17002, Co 17003, Co17004, Co 17005, Co 17010, Co 17012 and Co 17013) and three standards (Co 09004, Co 86032, CoC 671) were evaluated for their nutrient content in trash and cane separately and expressed as percentage. The nitrogen, phosphorus and potassium content in the trash ranged from 0.45 to 0.63, 0.05 to 0.08 and 0.57 to 0.84 % respectively. While nitrogen, phosphorus and potassium content in the cane ranged from 0.46 to 0.68, 0.03 to 0.08 and 0.35 to 0.53 % respectively. The uptake of N, P and K ranged from 271.28 to 376.82, 18.63 to 44.48, 221.26 to 287.36 kg ha-1 respectively. Reciprocal internal use efficiency of nutrients also calculated for N, P and K and the clone Co17001 requires 1.86, 0.13 and 1.60 kg N, P and K for producing 1 tonne of sugarcane and shows higher nutrient use efficiency than other clones and standards.

(V. Kasthuri Thilagam)

Externally Funded Projects

Sub-cellular targeting of invertase inhibitory proteins: a novel approach to enhance sucrose yield in sugarcane

Sugarcane invertase inhibitors (ShINH1 and ShINH2) overexpressed transgenic lines were successfully developed through sub-cellular targeting under DST-ECR project . Currently, a total of 63 transgenic events having with/without vacuolar targeting sequences (ShINH1+VT, ShINH1-VT and ShINH2-VT) were developed in which 29 transgenic events are in V2 generation, 37 events are in V1 generation. These were selected after PCR confirmation from many putative transgenic events. PCR confirmation of transgene was done using three sets of primers specific for the regions within the gene, promoter and hygromycin resistance marker. PCR confirmed over expressed lines are maintained in transgenic glass house facility at ICAR-SBI under controlled conditions. These transgenic events were developed using four gene constructs, having two invertase inhibitor genes (ShINH1 and ShINH2) identified by us earlier. These gene constructs were developed by cloning into modified pCAMBIA1305.2 vector developed earlier at our institute, which had the Porteresia coarctata Ubiquitin promoter fused with GRP (glycine-rich protein) signal peptide (SP) and vacuolar targeting determinant (VT78).

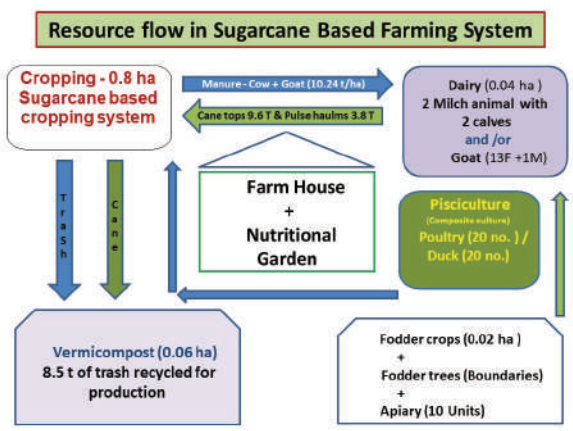
In order to validate the sub-cellular targeting of transgenic events, we have developed the constructs mimicking the stable transformation events by fusing the GFP fluorescent marker protein at C-terminal end of ShINH1 and ShINH2 protein. These constructs were transformed into sugarcane embryonic Calli for transient expression assay and GFP expression was observed under fluorescent microscope. The results have clearly indicated the sub-cellular (Vacuole, Cell wall and or Cytoplasm) localization of inhibitor proteins. Preliminary examination of transgene expression revealed 3-10-fold increase in the expression of invertase inhibitor gene over untransformed control (wild type). Brix% content also significantly increased over wild type control. Apart from these studies, we have also performed genome wide identification and isolated 17 invertase gene homologues from sugarcane genome and developed the temporal and spatial expression profiles of these gene homologues to understand their role in sucrose accumulation in sugarcane. Based on the results obtained and lead taken through our DST-ECR project, work is under progress to evaluate the transgenic events for sucrose yield and juice quality and yield parameters in sugarcane.

As per the results from the 8th month juice analysis for the current year revealed that 5 transgenic events namely ShINH2+VT-16, ShINH2+VT-25, ShINH2+VT-29, ShINH2+VT-32 and ShINH2+VT-44 reported 2-3 percent increased sucrose yield over untransformed control. Further analysis of juice analysis in 12th month canes revealed significant increase in sucrose yield over untransformed control. The event ShINH2-VT-5 showed the highest sucrose content of 20.37% against untransformed controls Co 62175 (16.42%) and Co 86032 (19.93%). Similarly, events P1+VT-3 (18.53%), P1-VT-2 (18.68%), P2+VT-3 (17.21%), P2+VT-16 (18.07%), P2+VT-18 (17.32%), P2+VT-25 (17.0%), P2+VT-29 (19.19%), P2+VT-30 (17.16%), P2+VT-31 (17.20%), P2+VT-32 (17.66%) and P2-VT-14 (18.07%) recorded 0.5 to 2.5% improvement of sucrose over untransformed control. Southern blot of transgenic events has been successfully developed to validate transgene presence and copy number in the sugarcane genome of transgenic events. The results from this study revealed that integration of transgene in the transgenic events varied from 2-6 copies and validated the PCR based confirmation of transgenic events. The results indicated clearly demonstrated the development of transgenic events in sugarcane and studied the positive effect of sub-cellular targeting and over expression of invertase inhibitor proteins in sugarcane for sucrose yield and quality.

(G.S. Suresha)

Doubling income of small farms through sugarcane based farming system (NADP/RKVY)

Studies on doubling income of small farms through sugarcane based farming system was initiated during 2019-20 with the objectives of setting up a model farm to demonstrate the extent of diversification and possibility of varied agro-based enterprises at ICAR- Sugarcane Breeding Institute, Coimbatore and for empowering human resource for the sustenance of the proposed activities through on-farm capacity development programs. The components of the IFS are Crop (sugarcane + intercropping with pulses) (0.8 ha), dairy (0.04 ha), stallfed goat (0.04 ha), fodder (0.02 ha), vermicompost unit (0.06 ha), aquaculture (0.04 ha) with poultry shed over the pond), duck unit and mushroom unit. The economics for the individual enterprises have been worked out and the complementarities between them were enumerated. The results indicated that dairy unit is found to be the most promising with higher gross and net returns of Rs.3,52,000 and Rs.1,07,000/year respectively. This is followed by the stallfed goat unit with a net return of Rs. 88,710.



Resource flow in Sugarcane Based Farming System

(P. Geetha, T. Rajula Shanthy, C. Palaniswami, R. Karuppaiyan-ICAR-SBI, Coimbatore; M. Thirunavukkarasu-TNAU, Coimbatore)

Intellectual property management and technology transfer/ commercialization – Institute Technology Management Unit (ITMU) (National Agricultural Innovation Fund scheme (NAIF) - Component I, IP & TM, ICAR)

Coordinated ITMC meetings and Techno Commercial Assessment Agrinnovate Tripartite meetings. Conducted World IP day by conducting a seminar on 30.04.2024 and zoom meeting on "Applying copyright for Publications". Demonstrations were given to officials from Department of agricultural engineering, Government of Tamil Nadu with a team of 40 numbers of farmers on DSMS and ICAR-SBI CIAE Sett Treatment Device. Demonstration on DSMS technology was given in the farmers in a meeting organised by The Coimbatore District Collector. Received registration certificates for 5 varieties from PPV&FRA. One application as extant variety for 'Sugarcane Co 18009' submitted and annual maintenance fee for four varieties. Two patents and one design patent was granted, one bacterial culture with ICAR-NAIMCC, NBAIM, Mau and one patent and one trademark application filed. Four NBA Form 2 applications were submitted pertaining to export of varieties and energycane to foreign countries. Five new technology disclosures processed. Licensed Soil Moisture Indicator technology, SBIEC14006 - An Energycane with High biomass production, standardized liquid jaggery technology, ICAR-SBI EPN Biopesticide formulation, production of cane jam from sugarcane juice *Cotesia flavipes* and *Telenomus dignus* mass multiplication technology against internode borer with release station, ICAR-CIAE-SBI- Small Tractor Operated EPN Applicator for sugarcane white grub management and ICAR-SBI CIAE Sett Treatment Device.

(K. Hari, V. Krishnapriya and Kona Praveen)

Agricultural drone project funded by ICAR-agricultural technology application research institute, hyderabad under sub mission on agricultural mechanization: Drone technology demonstration

Demonstration of sprayer drone technology

Conducted 142 field demonstrations of agriculture sprayer drone in 80.04 ha (200.1 acres) in the sugarcane farmers' field located in the region of Kothari Sugars and Chemicals Limited, Sathamangalam Unit, Ariyalur District, Tamil Nadu. Micro-nutrient mixtures and plant protection chemicals were sprayed using the 10 L capacity drone in the sugarcane crop based on the requirement and sugarcane farmers showed a lot of interest in drone demonstration. The drone was allowed to fly around 2 m above the sugarcane crop canopy and could spray around 10-13 L of spray fluid per 0.5 acres in 10 minutes. Twenty liters of spray fluid were sprayed using the drone in a one-acre area. Also, one sprayer drone demonstration was organized exclusively for all the scientists and technical staff of ICAR-Sugarcane Breeding Institute, Coimbatore in the main farm of ICAR-SBI, Coimbatore on 22 August, 2023. The various

advantages observed with drone technology were time-saving, quick coverage, minimal handling of chemicals and minimum exposure to chemicals, water saving, and uniform coverage. The disadvantages /drawbacks of the drone technology were the drift effect, not being suitable for fields with coconut trees as border crop/inter crop & electric lines in between the field, critical stage of crop stand, the requirement of skilled person/licensed pilot for drone flying and powder formulations are difficult to use when compared to liquid formulations. The measures for enhancing/accelerating the adoption are an extensive demonstration of this technology, sensitizing this technology to farmers and other stakeholders like sugar factory personnel, agricultural officers *etc.*

Field demonstration of sprayer drone technology

(T. Arumuganathan)

Improving water use efficiency and economizing water use in sugarcane cultivation in sub-tropical India (ISMA-funded)

An experiment has been conducted in RBD design with 7 methods of irrigation as treatments. Irrigation was given as per IW/CPE ratio. The treatments were T1: Irrigation at critical stage (Farmer's practices), T2: Trash mulching, T3: Skip furrow Irrigation, T4: Trench method of Sugarcane planting, T5: Flat planting Sugarcane (Rec Irri Scheduling), T6: Drip irrigation in sugarcane, T7-Prominent cropping system (Maize -Blackgram-Rice). The crop was harvested at 12th month and juice analysis and yield parameters were recorded. The results indicated that, cane yield was significantly higher in drip irrigation (165.28 t ha^{-1}) followed by trash mulching (134.29 t ha^{-1}) and skip furrow irrigation (130.79 t ha^{-1}). However, trash mulching and skip furrow were on par with farmers' practice of irrigation scheduling (131.89 t ha^{-1}). Similarly, the CCS% and CCS yield were also high in drip irrigation system (13.67 and 22.59 t ha^{-1}). The irrigation water applied was comparatively less (415.8 mm ha^{-1}) in drip irrigation system followed by trash mulching (785.4 mm ha^{-1}) and skip furrow (786.0 mm ha^{-1}) respectively when compared to farmers' practice (913.8 mm ha^{-1}) and prominent cropping system (947.6 mm ha^{-1})

(P. Geetha and S. Anusha)

5.3. Crop Protection

5.3.1 Plant Pathology

Host resistance, interactomics, pathogen variability, diagnosis and disease management in sugarcane

Evaluation of sugarcane germplasm/clones for red rot resistance

Control Condition Testing for red rot

Resistant *Moderately Resistant* *Moderately Susceptible* *Susceptible* *Highly Susceptible*

Categorization of sugarcane clones for red rot resistance under controlled conditions, internal symptoms on the inoculated stalks, arrows indicate the inoculated nodes

A total of 3177 clones from different clonal trials, parental clones from NHG, germplasm and waterlogging tolerant clones from Kannur, ISH and IGH clones, Energy canes, PZVT-2024 series, PZVT multiplication. BC2 hybrids of *Erianthus procerus*, Red flesh hybrids, Economic breeding, Inbreeding, Genomic selection, ISMA, Targeted Pre-breeding and Clonal trial clones were screened under CCT. Among the screened clones, 580 clones (18.26%) were free from red rot infection and rated as resistant (R) and 655 clones (20.62%) were categorized as moderately resistant (MR). Around 1157 clones (36.42%) were rated as susceptible (S) and 615 clones (19.36%) were grouped as moderately susceptible (MS) and around 150 clones (4.72%) were rated as highly susceptible (HS). The susceptible clones were mainly from basic germplasm and many R and MR clones were from first and second clonal trials.

Clones kept for red rot screening after inoculation with Colletotrichum falcatum spore suspension in the nodal regions

(R. Selvakumar, A. Ramesh Sundar, P. Malathi, V. Jayakumar, R. Ramesh, R. Gopi and A. Jeevalatha)

Field tolerance to red rot

Six PZVT clones (2022-44, 2022-71, 2022-109, 2022-154, 2022-170, 2022-201) of 2022 series along with 3 standards were planted in field both under pathogen inoculated (against CF06 and CF12 as soil borne inoculum) and healthy condition to test their field tolerance. Both under healthy and pathogen inoculated conditions the highest per cent of germination was recorded in Co 86032, while the PZVT clones showed drastic reduction in germination under pathogen inoculated conditions. Under artificially inoculated conditions all six tested PZVT clones picked up red rot infection for both the pathotypes, i.e., 16 to 24% red rot incidence was recorded with CF06 and 16 to 35% red rot incidence was recorded with CF12 pathotype. Hence, it is concluded that none of the tested PZVT clones has field tolerance. However, among the tested clones 2022-154 showed least incidence of red rot (16%) for both the pathotypes.

(V. Jayakumar and R. Selvakumar)

Sugarcane quarantine

During the crop season, 37 genotypes from 10 centres *viz*., Anakapalle, Kapurthala, Kushinagar, Lucknow, Pantnagar, Phaltan, Rudrur, Samastipur, Sankeshwar and Shahjahanpur were received for observation in quarantine before planting in the National hybridization Garden (NHG) and National Active Germplasm (NAG) at ICAR- SBI, Coimbatore. For NHG, five clones (CoSe 11453, CoS 18231, CoS 18232, 2015 A 311 and 2017 A 553) were received and after observation for one year, they were carried forward to NHG. There were 32 genotypes received for NAG and out of those only two genotypes (CoH 20261 from Uchani and GUK 14-48 from Kannur) were unable to establish at Coimbatore and remaining 30 genotypes were allowed for NAG.

Centres which supplied sugarcane clones for NHG and NAG

(R. Selvakumar and A. Ramesh Sundar)

Virus Indexing

Nearly, 76 TC plants were received from TC lab, ICAR-SBI for virus indexing from the cvs. Co 86032, Co 11015, Co 18009, and Co 14012. RT-PCR was followed for all the viruses using the coat protein primers and nested PCR was followed for the SCGS phytoplasma. Test results showed 82% (63/76) and 15% (12/76) of TC materials were free from SCYLV and SCGS phytoplasma.

(K. Nithya and P. Malathi)

Harnessing antagonistic microbes for the management of wilt and rot diseases in sugarcane

A total of 100 Trichoderma and 220 bacterial isolates were isolated from the rhizosphere region of different sugarcane germplasm and allied genera for the management of wilt and rot diseases in sugarcane. All the isolates were studied for antagonistic properties and growth promotion such as, HCN production, siderophore production, cellulase production, phosphate, zinc and potassium solubilization *etc.* All the cultures were also tested under *in-vitro* conditions against sett rot, wilt, stalk rot pathogens. Later considering the importance of wilt and red rot in sugarcane, the isolated bacteria and Trichoderma cultures were evaluated for wilt and red rot under pot and field conditions.

Trichoderma and PGPR isolated from the rhizosphere were tested using the variety CoC 671 and Co 86002 against the red rot (*Colletotrichum falcatum*) and wilt (*Fusarium sacchari*) respectively. In Pot culture study, among the treatments, setts treated using different *Trichoderma* isolates such as, T12 @ 0.25% recorded maximum germination of 90% followed by TK13, TK16 (80%) respectively and among the treatments in wilt study, PF4@ 0.25% recorded a maximum of 75% germination. However significant disease control was not observed in pot culture experiment.

In the field, biocontrol treatments such as T12, TK13, TK16, PF4, BC29, along with Thiophanate methyl (0.1%) and infected control and healthy control, were used for the management of red rot using the variety CoC 671. The Trichoderma isolate TK13 recorded maximum germination per cent (62.57), next to healthy control and also recorded significantly maximum tiller count (31) and maximum NMC (26). The percent disease incidence was lower in all the treatments in comparison to infected control and the lowest incidence was recorded in the rhizosphere bacteria BC 29(6.00%) and it was next to healthy control (0.71%), followed by T12 (8.74%) and TK13 (9.51%). Similarly, in wilt field trial, T12, TK13, TK16, TK19, PF4, PF59, BC29, along with propiconazole (0.1%), infected control and healthy control were used for the management using the variety Co 86002. The germination per cent was maximum in T12(77.50%) followed by TK13(71.25%), whereas tiller count and number of millable cane were maximum in TK13 (32.5 and 26.5 respectively).

Disease was not recorded in many of the treatments, and very less incidence of wilt was recorded in the treatments such as infected control, PF59 and PF4. In this project, two Trichoderma and one bacterial isolate were identified for red rot disease management.

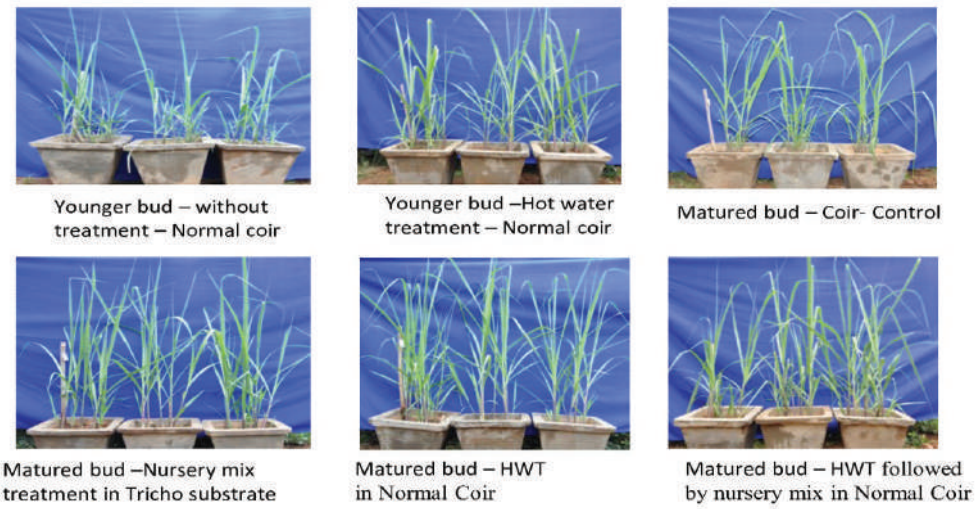
(R. Gopi and K. Nithya)

Smart delivery of agro-inputs using Sett Treatment Device for biotic and abiotic stress management in sugarcane and other vegetatively propagated crops

Efficacy of mechanized priming of planting material was validated as an inter-institutional activity with 6 ICAR institutes on validation of mechanized priming with physical, chemical and biological agents for the management of fungal, bacterial, phytoplasma viral diseases and nematode in various vegetatively propagated crops *viz*., sugarcane, tapioca, banana, ginger, turmeric and horticultural crops. During 2024, following experimental results were reported by various institutes.

ICAR-SBI: Efficacy of settling production with various agro-inputs against non-fungal diseases

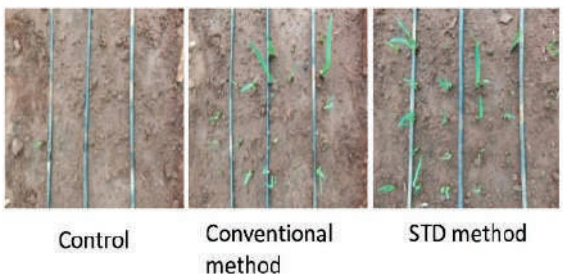
Settlings were raised from single bud setts of YLD infected Co 86032 and GSD infected CoV 92101 by treating them in hot water at 54^{0}C followed by nursery inputs with a combination of fungicide, insecticide and nutrients and then planting in substrate mixed with bioformulations of *Paenibacillus alvei* and *Trichoderma* spp. (*T. harzianum and T. asperellum*), individually and in combination along with appropriate controls. Results revealed that, the sett treatment with hot water followed by chemicals significantly improved germination. Further, it is inferred that, raising settlings from setts treated with hot water and chemicals along with addition of bioformulation significantly reduced GSD expression (>90%) and YLD expression (<50%) till harvest with enhanced cane growth.



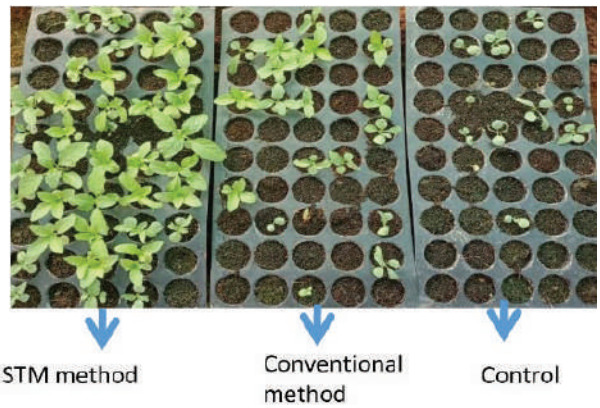
Effect of physical, chemical and bioagents on germination, growth and vigour of YLD infected Co 86032 bud chips

ICAR-IIHR: Effect of mechanized sett treatment with different agro-inputs on ornamental crops

The impact of sett treatment using STD on ornamental crops was investigated to assess its influence on growth and *Fusarium* wilt incidence. Four ornamental crops, namely Gladiolus, Chrysanthemum, Tuberose, and Crossandra, were selected for the study. Each crop underwent three distinct treatments: 1. Mechanized treatment, 2. Conventional method, and 3. Control. Gladiolus corms and Tuberose bulbs were subjected to a treatment consisting of *Bacillus amyloliquefaciens* (5gm/l) + Tebuconazole 25EC 500 ppm by above methods, revealing a significant improvement in germination by suppressing the Fusarium incidence by machine-treatment over control. Similarly, Crossandra seeds treated with *Trichoderma harzianum* 5gm/l + Copper oxychloride 2000 ppm + Arka Actino plus 5gm/l + Fosetyl Al 2000 ppm, recorded highest seed germination by mechanized treatment, which indirectly indicates reduction in Fusarium wilt incidence.



Effect of mechanized treatment on germination of gladiolus corm



Effect of mechanized treatment on germination of crossandra

ICAR-NRCB: Effect of mechanized treatment of corms with different inputs on growth promotion in Banana

After studying the efficacy of mechanized treatment of corms with biocontrol agents against wilt incidence, validated the efficacy of mechanized treatment with hot water at 54^{0}C and combination of chemical inputs (fungicide-propiconazole, insecticide-thiomethoxam, nutrients – Urea, ZnSO4, FeSo4) for growth promotion in banana. These treatments were again validated along with bio-formulation of FYM with Trichoderma as substrate for planting corms. Significant difference in growth promotion was observed in treatment T3 and T4 and the treatments will be validated for disease management of future.

Treatment Details

T1 - Pot mixture without corm treatment

T2 – *Trichoderma* formulation without corm treatment

T3 –STD with fungicide + insecticide + Nutrients in pot mixture

T4 – STD with fungicide + insecticide + Nutrients in *Trichoderma* formulation

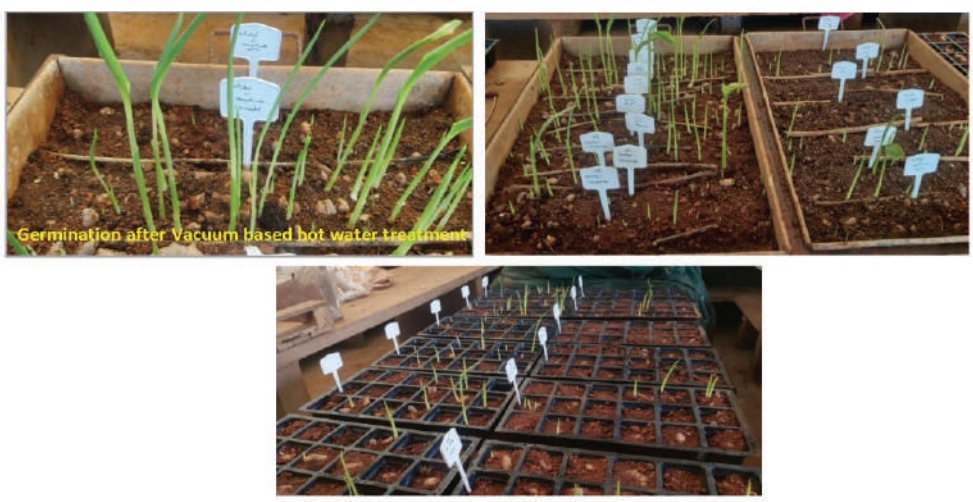
T5 – STD - HWT with fungicide + insecticide + Nutrients in pot mixture

T6 – STD – HWT with fungicide + insecticide + Nutrients in *Trichoderma* formulation

Effect of physical, chemical and biological agents on germination, growth and vigour of banana

ICAR-IISR: Effect of physical and chemical treatment on nematode incidence in Turmeric

Lesion nematode infested turmeric material was treated at various temperatures *viz*., 50, 52 and 54^{0}C individually and followed by nematicide (Fluopiram 34.48SC) and nursery inputs. Invariably all the treatments improved the germination and vigour of the plantlets, which indirectly indicates the suppression of nematode infestation in the planting material. Among the treatments, hot water at 54^{0}C, had significantly reduced the nematode population in the infected rhizomes as compared to untreated control and the nematode mortality was 66.8%, 78.25%, 89.4% at 50^{0}C, 52^{0}C at 54^{0}C respectively. The effect of treatment on germination of nematode infected rhizomes showed 92.0%, 93.4.0%, 82.5%, respectively and untreated control recorded 89%, while healthy rhizomes exhibited 95.5%, 96.6%, 90.5% and untreated control at 96%, respectively.

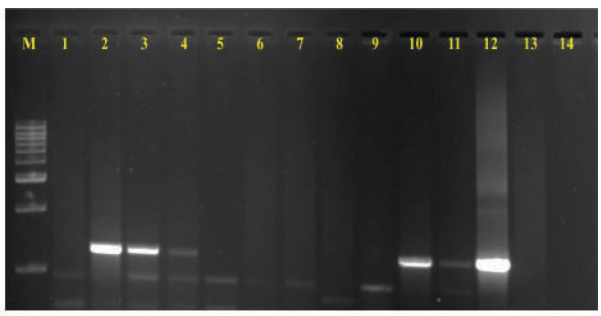


Effect of vaccum based hot water treatment against lesion nematode in turmeric

(P. Malathi, A. Ramesh Sundar, R. Selvakumar, V. Jayakumar, K. Nithya, A. Vennila, T. Ramasubramanian, T. Rajula Shanthy, R. Gomathi (All from ICAR-SBI), R. Viswanathan, (IISR, Lucknow) Ravindra Naik (ICAR-CIAE); S.S. Veena (ICAR-CTCRI); R. Thangavelu (ICAR-NRCB); Priti Sonavane (ICAR-IIHR); G. Karthikeyan (TNAU) and Priyank Hanuman Mhatre, ICAR-CPRI, Ooty)

Sugarcane phytoplasma diseases: diagnosis, understanding the molecular mechanism of plant host phytoplasma interactions

SCGS phytoplasma (*Ca.* Phytoplasma sacchari) host tissue localization was confirmed by nested PCR assay on two different cv. Co 86032 and CoC 671 collected from the infected clumps. Different host parts *viz*., root, fourth, sixth and top nodes from bottom, apical meristem region, first and third dewlap leaves were taken for the analysis from both varieties. Nested PCR analysis had shown the expected 1.2kb amplification from all the samples. With this study, it has been established that SCGS pathogen in all parts of host tissues including the top apical meristem regions. In search of insect vectors, apart from aphids, *Pyrilla perpusilla* and *Proutista moesta* were found predominant in the GSD clumps of many varieties. Samples were collected and subjected to nested PCR analysis and all the samples were positive to the pathogen and the results were further confirmed by sequencing in that, it had shown 99% identity to the *Ca.* Phytoplasma sacchari sequences submitted from our country. Whole genome mining of SCGS phytoplasma revealed 404 protein-coding genes, of which about 7.5-8.2% were identified as virulent proteins/ effectors using the bioinformatics tools. Two to three sets of primers for each protein coding genes were designed using Primer3 explorer and the oligonucleotides were synthesized. PCR conditions were optimized for all protein coding genes using the CoC 671 samples. In order to confirm the specificity of the primers, total DNA was extracted from apparently healthy samples of different cvs. Co 11015, CoV 09356, Co 86032, Co 0238, Co 94012, Co 6806, Co 93009, Co 419, CoC 671 and Co 09004 in which 37.5% were confirmed as SCGS phytoplasma free by nested PCR analysis.



M: 1 kb ladder (Origin); L1-4: Co 11015 ; L5: CoV 09356; L6: Co 93009; L7: Co 86032; L8: Co 0238; L9: Co 419; L10: Co 94012; L11: Co 6806; L12: PC; L 13-14: NC

Nested PCR analysis of apparently healthy samples

(K. Nithya, R. Manimekalai, M. Punithavalli and V. Krishnapriya)

Structural and functional characterization of endophytic bacterial microbiome of sugarcane

Isolation of endophytic bacteria: The varieties *viz*., Co 86032 collected from tropical region (Coimbatore) and Co 0238 collected from sub-tropical region (Karnal) were subjected to endophytic bacteria isolation by following already developed surface sterilization protocol. From leaves, cane and roots of these two varieties a total of 463 endophytic bacteria i.e., 240 from Co 86032 and 223 from Co 238 were isolated.

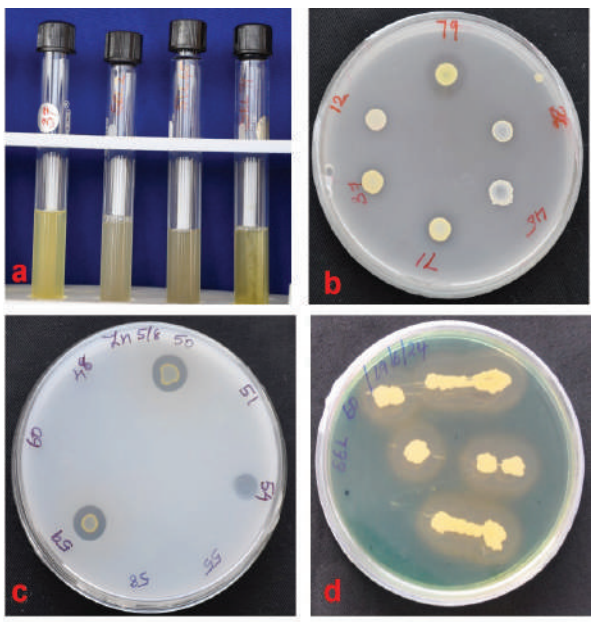
Cultural and morphological characterization of endophytic bacteria: All 463 endophytic bacteria were characterized based on morphology and culture characters such as form, elevation, margin, surface, colony colour *etc.* Among the isolated bacteria, white and yellow colonies were dominant and in case of shape the circular colonies were found to be dominant followed by rhizoid colonies. In case of colony margin the entire, regular and undulate colonies were dominant in leaf, cane and root isolates. Grouping of isolated bacteria based on morphology and culturural characters showed the presence of 46 morphotypes in Co 86032 and 64 morphotypes in Co 0238.

Functional characterization of endophytic bacteria: A set of 51 endophytic bacteria isolated from leaves of Co 86032 were screened for various plant growth promoting (PGP) and antagonistic properties under *in-vitro* condition by following standard methodologies.

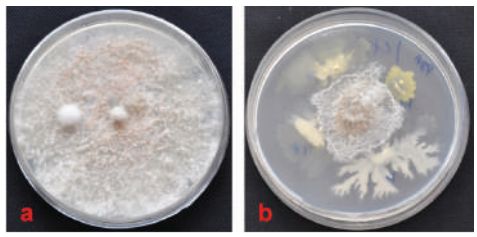
Assessing PGP properties: The PGP properties such as ammonia production, phosphorous (P) solubilization, Zinc (Zn) solubilization, siderophore production and IAA production by each bacterium were assessed. Among 51 bacteria 27 produced ammonia, 44 solubilized P, 35 solubilized Zn, 33 produced siderophore and all 51 produced IAA, in which the bacteria SEL 36, SEL 47, SEL 59, SEL 73, SEL 83 produced more ammonia, SEL 69, SEL 81 showed more P solubilization, SEL 5, SEL 10, SEL 22, SEL 30, SEL 81 showed more Zn solubilization, SEL 45, SEL 48, SEL 55, SEL 61, SEL 62, SEL 67, SEL 81, SEL 84 produced more siderophore and SEL 45, SEL 76 produced more IAA. The bacteria showing various PGP properties are presented in figure.

Assessing antagonistic properties: The bacteria were screened *in-vitro* for their antagonistic potential against red rot (*C. falcatum*) and wilt (*F. sacchari*) pathogens by dual culture technique and qualitative assessment of HCN production. Among the tested bacteria, 44 exhibited antagonistic potential against *C. falcatum*, in

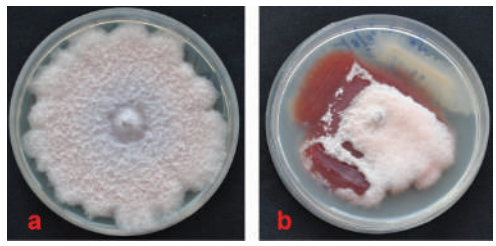
which 7 bacteria *viz*., SEL 4, SEL 45, SEL 50, SEL 60, SEL 62, SEL 71, SEL 84 showed strong antagonistic property by inhibiting mycelial growth of *C. falcatum* >50% and 36 showed moderate antagonistic property by inhibiting mycelial growth from 25 to 50%. Screening against *F. sacchari* showed that forty bacteria could exhibit antagonistic property, in which five bacteria *viz*., SEL 37, SEL 45, SEL 55, SEL 60, SEL 62 showed moderate antagonistic potential (25 to 50%) and the remaining had poor antagonistic property. Among fifty-one bacteria tested for HCN production, 5 produced HCN and remaining were -ve for HCN production.



PGP properties of endophytic bacteria. a. Ammonia production; b. P solubilization; c. Zn solubilization; d. Siderophore production



Antagonistic properties of endophytic bacteria against C. falcatum. a. Control; b. Mycelial growth inhibition by endophytic bacteria



Antagonistic properties of endophytic bacteria against F. sacchari. a. Control; b. Mycelial growth inhibition by endophytic bacteria

(V. Jayakumar, R. Gopi, P.T. Prathima and K. Hari)

Characterisation of *Fusarium* species associated with sugarcane *Pokkah boeng* (PB) and their management

The varieties *viz*., Co 12009, Co 10026, Co 13013, Co 0212, Co 09004, Co 11015, Co 18009, Co 0238, Co 0118, Co 15023, Co 05011, Co 06022, Co 06030, Co 92005 and Co 86032 were monitored for the appearance of *Pokkah boeng* (PB). PB was noticed on many varieties as a mild to severe incidences. However, all the varieties recovered from the incidence after spraying with propiconazole @ 0.5 ml per litre of water and developed new leaves, which were free from any PB symptoms.

Various stages of Pokkah boeng symptoms (Chlorosis, necrosis, twisted leaf and knife cut)

From the earlier work at ICAR-SBI, it was reported that *F. sachhari* was responsible for causing wilt and *pokkah boeng* however, the role of other *Fusarium* species (*F. verticillioides, F. andiyazhi, F. hygamai, F. proliferatum*) need to be evaluated. In a preliminary study, five species of *Fusarium* isolated from sugarcane were inoculated on eight varieties *viz*., Co 86002, CoT 8201, MS 901, Co 86010, ISH 100, Co 98010, Co 94012 and Co 93009 individually to observe the wilt development 60 days after inoculation in the field. It was observed that all species were not inducing wilt symptoms indicating the different role play of different *Fusarium* species in sugarcane disease initiation.

Screening for Sugarcane and Fusarium interactions in the field 60 days after inoculation

(R. Selvakumar, V. Jayakumar, R. Gopi, R. Arun Kumar and M.L. Chhabra)

Deciphering the mechanism of gain of virulence in *Colletotrichum falcatum* vis-à-vis breakdown of red rot resistance in sugarcane

Four designated *C. falcatum* pathotypes (CF06, CF12 and CF13) along with one avirulent/ less virulent *C. falcatum* isolate (*Cf 92020*) were selected for the study. Total genomic DNA from these *C. falcatum* isolates was extracted and whole genome sequencing of the selected isolates is in progress.

Characterization of *C. falcatum* pathotypes: Thirteen designated *C. falcatum* pathotypes (CF01 to CF13) were characterized by cultural, morphological and microscopic characteristics.

Among the 13 pathotypes, two morphotypes were observed. One with conidiomata in acervuli with orange conidial masses with white aerial mycelium (CF01, CF05, CF06, CF11, CF12 & CF13) and the other with aerial mycelium, medium grey to pale buff in center, entirely covered with floccose to dense (CF02, CF03, CF04, CF07, CF08, CF09 and CF10). All isolates were fast-growing and the growth rate ranged from 10.6 mm to 13.6 mm/ day. Falcate-shaped conidia were observed. The average conidial length ranged from 14.38 µm to 30.41 µm and width from 4.01 µm to 7.39 µm.

Multi Locus Sequence Typing (MLST) of *C. falcatum*: Six genes *viz*. Internal Transcribed Spacer (ITS), Actin (act), Chitin Synthase 1 (chs 1), Histone 3 (his3), β- tubulin 2 (tub 2), Calmodulin (cal)) were selected for MLST studies. PCR amplicons from all the pathotypes were sequenced and aligned. Preliminary results indicated minor variation of sequences in few of the genes.

(R. Ramesh, A. Ramesh Sundar and A. Jeevalatha)

Exploration of rhizosphere microbes for the management of red rot (*Colletotrichum falcatum*), wilt (*Fusarium sacchari*) in sugarcane

Rhizosphere soil samples were collected from different sugarcane growing areas such as Mathur and Kurunkulam of Tamil Nadu, Kannur in Kerala and Akbarpur (Balrampur chini mill), Manpur (Seksaria Biswan Sugar mill), Loni (DCM Shriram sugar mill), Nigohi (Dalmia Bharat sugar mill) Milak Narayanpur (Triverni sugar), Masodha (KM sugar) Bundki (Dwarikesh sugar mill), and Bilai (Bajaj Hindustan Sugar mill) of Uttar Pradesh *etc*. Totally 28 soil samples were collected. Serial dilution was done for the isolation of bacteria and actinobacteria using Nutrient agar and Casein Starch Agar media, respectively. Totally 70 bacterial cultures and three actinobacterial cultures respectively were isolated.

(R. Gopi, V. Jayakumar, M.L. Chhabra, T. Ramasubramanian and G.S. Suresha)

Genome-wide analysis of effector coding genes in *Colletotrichum falcatum* and identification of their counterparts in sugarcane

Identification of the crucial effectors involved during *C. falcatum* infection in sugarcane was initiated with inoculation of eight months old sugarcane cultivars resistant (Co 93009) and susceptible (CoC 671) to *C. falcatum* with isolate Cf6 using nodal inoculation method and samples were collected at different time points; 0, 12, 24, 48, 72, 120 and 240h post-inoculation (hpi). Total RNA was extracted from the inoculated canes using standard protocols for transcriptome sequencing.

(A. Jeevalatha, R. Ramesh, A. Ramesh Sundar, G.S. Suresha and P.T. Prathima)

Externally Funded Projects

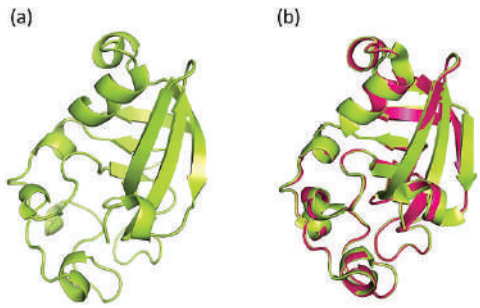
ICAR-genome editing project-"Enhancing climate resilience and ensuring food security with genome editing tools"- Genome editing in sugarcane for biotic stress tolerance

Cation exchanger 4 (CAX4) gene is a negative regulator of resistance to pathogen infection in sugarcane. Hence, CAX4 gene was selected as a target for editing sugarcane genome for red rot resistance. QPCR assay was carried out to analyse the CAX4 gene expression in inoculated susceptible (CoC 671) and resistant (Co 93009) sugarcane cultivars. The results showed upregulation of CAX4 in susceptible cultivar COC 671, while there was no change in resistant cultivar (Co 93009). The CDS of CAX4 gene of sugarcane cultivar ROC22 was used in blast search in sugarcane genome hub to retrieve the CAX4 gene sequence of R 570. They shared 82.30 % identity at nucleotide level. Primers were designed to amplify complete gene (5461 bp) and also coding sequence (1254 bp) of CAX4 gene. Cloning and sequencing of CAX4 gene is in progress.

(A. Ramesh Sundar, R. Ramesh and A. Jeevalatha)

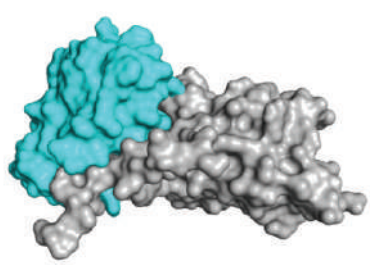
Decoding the molecular events of PAMP-triggered immunity (PTI) by unlocking the interactome of the PAMP-CfEPL1 of *Colletotrichum falcatum* during interaction with sugarcane (DST-SERB)

The project envisages unravelling the molecular mechanisms involved in PAMP-triggered immunity (PTI) in sugarcane by exploring the interactome of the PAMP-CfEPL1 protein from *Colletotrichum falcatum* during its interaction with its host- sugarcane. Key achievements include the successful expression and purification of the CfEPL1 protein, detailed structural modelling, and in-depth analysis of its interaction with sugarcane defense-related proteins. CfEPL1 gene was cloned into the pET28a expression vector and expressed in *E. coli*. Following expression, the protein was purified using affinity chromatography. For interaction studies, total protein extracts were prepared from two sugarcane varieties with red rot-resistant variety (BO 91) and susceptible variety (CoC 671). These protein extracts were used in pull-down assays, wherein the purified CfEPL1 protein was used as a bait to capture potential interacting proteins from sugarcane. Further, the tertiary structure of CfEPL1 was modelled using the MODELLER 10.2 software using *Trichoderma virens* Sm1 protein as the template for modelling (Fig.1). The accuracy of CfEPL1 structural model was validated by TM-align analysis (TM score of 0.998), ERRAT analysis (score-91.07) and Ramachandran plot analysis confirmed the stereochemical reliability of the model.



Tertiary structure of CfEPL1 (a) CfEPL1 modelled using MODELLER 10.2 (b) Modelled CfEPL1 superimposed with the template 3M3G and visualized using PyMol 2.5

To understand the functional implications of CfEPL1 during red rot pathogenesis, an *in silico* molecular docking study was performed to explore its interaction with sugarcane PR1 protein, a well-known pathogenesis-related protein. The PR1 protein was modelled using the *Solanum lycopersicum* PR1 protein (PDB ID: 1CFE) as a template *via*. MODELLER 10.2. Docking simulations were conducted using the ClusPro server. The docking results revealed significant binding interactions between CfEPL1 and PR1, suggesting that PR1 may be a putative target of CfEPL1 (Fig.2). Further, the stability and dynamics of the CfEPL1-PR1 complex was validated by molecular dynamics (MD) simulations using the GROMACS suite. These findings collectively suggest that CfEPL1 engages in specific interactions with sugarcane PR1 protein, potentially contributing to the modulation of sugarcane defence responses during red rot pathogenesis.



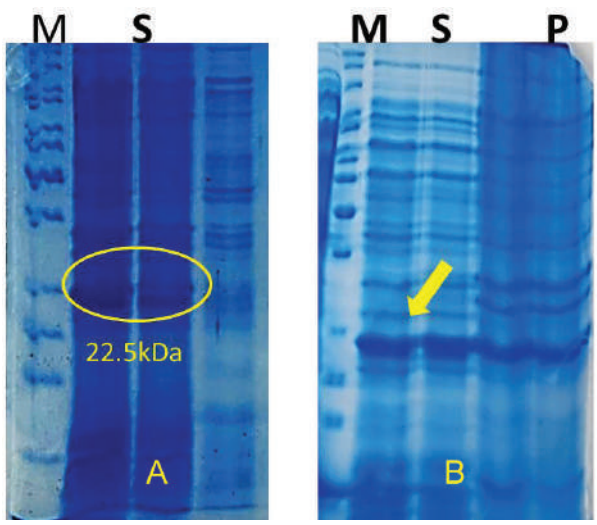
PR1-EPL1

The best docked poses for the protein-protein interactions between CfEPL1 and sugarcane pathogenesis-related protein PR1 were identified using the ClusPro server. In the visual representation, CfEPL1 is shown in cyan, while the PR proteins are shaded in grey.

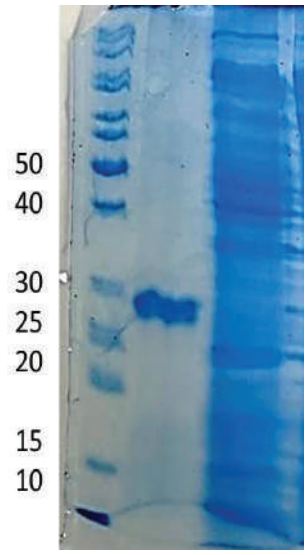
(A. Ramesh Sundar, V. Jayakumar, G.S. Suresha and P. Malathi)

ICAR- CRP on Development and application of diagnostics to viruses and phytoplasmas infecting sugarcane

For the SCYLV coat protein gene expression, the highly susceptible cv. 57 NG 56 was used and coat protein gene (591bp) was confirmed by RT-PCR. Prokaryotic expression vector pET 28 a(+) was used and the protocols were standardized for higher expression of the protein. Both induced and un-induced cultures were processed, crude supernatant were collected and pellets dissolved using lysis buffer (pH: 8.0) and was run on SDS-PAGE (12%) to determine the expected size of induction. Since the recombinant protein is found as inclusion body in cells, urea solubilisation was optimized at different concentrations and the expected size of protein (22.5kDa) was obtained from the supernatant. The cell pellets were subjected to RNA extraction and the expression of target ScYLV-CP was confirmed using specific primer. The solubilized protein was purified using Ni-NTA agarose resin column and was further concentrated by 10kDa amicon filters. The concentration of the protein was 0.75mg/mL which will be used for the polyclonal and monoclonal antibody development for the immunological diagnosis works.



A and B: SCYLV-CP obtained from Urea solubilisation
M- Protein ladder; S- supernatant; P- pellet



SCYLV-CP purified

(K. Nithya, D. Neelamathi and R. Selvakumar)

Mechanized priming of planting material and technology popularization for revival of sugarcane productivity in Tamil Nadu (RKVY)

This programme is aimed to disseminate the mechanized priming technology for healthy nursery programme and disease management in the main field along with settling transplanting techniques in sugar mills. In all the selected sugar mills including 5 Co-operative (i). Chengalrayan Co-op. Sugar Mills Ltd., Villupuram, (ii). The Kallakurichi Co-op Sugar Mills Ltd. – II, Kallakurichi, (iii). The Salem Co-op. Sugar Mills Ltd., Mohanur, Namakkal, (iv). Subramaniya Siva Co-op. Sugar Mills Ltd., Harur, Dharmapuri, (v). M.R.K Sugar mills Ltd. Sethiothope, Cuddalore; 2 Public mills *viz*., (vi). Arignar Anna Sugar Mills, Kurungulam, Thanjavur, (vii). Perambalur Sugar Mills Ltd. (Jawaharlal Nehru Sugar Mills) Eraiyur, Perambalur; 3 Private Sugar Mills *viz*., (viii). Bannari Amman Sugars Limited, Thirukoilur, Kallakurichi, (ix). E.I.D Parry (India) Limited, Nellikuppam, Cuddalore and (x). Kothari Sugars & Chemicals Limited, Kattur, Trichy, nursery units have been established by supplying Sett Treatment Devices followed by giving training and demonstrations to the factory staff entrepreneurs and farmers. Demonstrated mechanized means of treatment for the single bud setts with the combination of fungicide, insecticide and nutrients for healthy nursery programme and its effect on protecting the crop from fungal diseases and early season pests, particularly pokkah boeng and mealy bug along with improved yield in the main field. Participants for the small scale training and

demonstration varied from 10 to 50 in each sugar with a total of around 310 from 10 mills. In continuation, large scale demonstrations were conducted in all the 10 sugar mills during 2024, to create awareness among sugarcane farmers on the importance of mechanized priming for Healthy Nursery Programme and early season pest and disease management under field conditions. Number of participants varied from 100 to 150 and the total was 1480. As a result of training and demonstrations, all the selected mills started supplying settlings from setts treated with various agro-inputs for better disease management. Model farms have also been established in Bannari Amman Sugars and Kallakurichi (K2) Co-operative sugar mill to demonstrate the importance of healthy settlings, settling transplanting technology with the package of improved technologies. At the Instituture, shade net facility and model farm with recent varieties have been established for effective training and demonstrations.

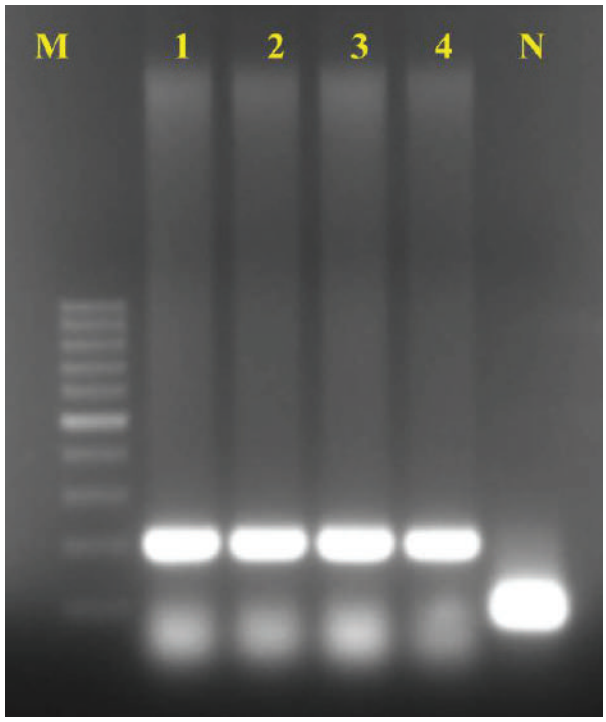
Large scale demonstrations of STD technology for farmers and entrepreneurs in selected sugar mills of TN under NADP-RKVY

(P. Malathi, A. Ramesh Sundar, R. Selvakumar, R. Gopi, T. Rajula Shanthy, A. Vennila, T. Ramasubramanian and Ravindra Naik (CIAE-RS, CBE))

Development of onsite field diagnostics to sugarcane grassy shoot disease Candidatus phytoplasma sacchari by RPA-LFD method to ensure healthy seed chain and sustain sugar production (DST-SERB)

Different sets of overlapping forward and reverse primers were designed from the highly conserved ribosomal of *Ca.* phytoplasma sacchari using Primer3 explorer. GSD samples from cv. CoV 92101, Co 86032, and CoC 671 were collected from the field and were confirmed by nested PCR assay. Initial standardization of RPA primers was done by gradient PCR and all the samples had shown the expected amplification of 210, 170 and 150 bp at 30-37°C. RPA reaction conditions

were standardized under isothermal conditions. In total of three primer sets tested, the primer set 1 showed consistent results in different samples tested *viz*., Co 86032, PI 16131, MS 17082, CoC 671, CoVC 17016, Co 16018, CoVSI 18121, PZVT 2021-92, CoT 18368, Co 0238 and CoVC 15062.



Lanes 1-4; Co 86032: 210bp
RPA results of Ca. phytoplasma sacchari

(K. Nithya (ICAR-SBI), R. Viswanathan (ICAR-IISR, Lucknow) and Susheel Kumar Sharma (ICAR-IARI, New Delhi))

Deciphering susceptibility ("S") genes for engineering red rot resistance in sugarcane through genome editing under All India Network Program (AINP) on biotech crops

The LOX3 gene sequence of maize was used in blast search to identify orthologous lipoxygenase gene in recently published sugarcane polyploid genome R570. The top hit lipoxygenase gene sequence showing 84.28 % identity was used to design primers for qPCR assay and to amplify the complete lipoxygenase gene (5494 bp). QPCR assay was carried out to analyse the lipoxygenase gene expression in inoculated susceptible (CoC 671) and resistant (Co 93009) sugarcane cultivars.

QPCR results showed upregulation of LOX3 gene expression in pathogen inoculated susceptible cultivar CoC 671 at all-time points with highest induction at 120 hpi when compared to un-inoculated plants. Whereas, no such induction was observed in pathogen inoculated plants of resistant cultivar Co 93009.

These results indicate the possible association of LOX3 gene with susceptibility of sugarcane cultivar CoC 671 to red rot pathogen. Genomic DNA was extracted from sugarcane cultivars (CoC 671, Co 0238) and the lipoxygenase gene was amplified, cloned and sequenced. Analysis of nucleotide sequence showed 100% identity to lipoxygenase gene from R570. The gRNAs were designed using CRISPOR software and cloning of gRNAs in pRGEB32 vector is in progress.

(A. Ramesh Sundar, A. Jeevalatha and R. Ramesh)

Dissemination of technology on mechanized priming of planting material for sustainable sugarcane agriculture (NFSM)

Small scale training and demonstrations were conducted in 9 sugar mills and UPCSR having Sett Treatment Device. In all the mills, a lecture on 'Role of mechanized priming technology for sustainable sugarcane agriculture' was given with suitable banner and pamphlets. Also demonstrated the technology with Sett Treatment Device, using different inputs *viz*., Thiophanate methyl alone or combination with Azoxystrobin and Tebuconazole/ Difenconazole @ 0.2 ml, Thiamethoxam 30FS/ Fipronil 5SC/ Imidacloprid (0.2 ml), Ferrous sulphate (0.5 g) Zinc sulphate (0.5 g) and Urea (0.5 g) per litre of water for healthy nursery programme and to create awareness among cane officials and farmers about benefit of sett treatment on plant growth, pest and disease management. In all the visited mills, based on awareness programme, they started supplying settlings/ setts treated in Sett Treatment Device.

Besides, integrated red rot management strategy covering healthy seed/ nursery programme by mechanized sett treatment with effective fungicides *viz*., thiophanate methyl/ Azoxystrobin, secondary application of fungicides by drenching/ sprays and application of bioformulations in the soil were advocated. From this 5 days programme, about 475 members including cane officials and farmers were benefitted.

K. M. Sugar Mills Ltd., Ayodhya

UPCSR and Avadh Sugar & Energy Ltd., Shahjahanpur

Dalmia Sugars, Nigohi, Shahjahanpur

Dwarikesh Sugar Ltd.,Bundki, Bijnor

Bajaj Hindusthan Sugar Ltd., Bilai, Bijnor

Triveni Engineering and Industries Ltd., Rampur

Training and demonstrations on mechanized priming technology using Sett Treatment Device

(P. Malathi, R. Gopi and M.L. Chhabra)

5.3.2 Entomology

Studies on sugarcane pests and their management

Isolation of novel Bt isolates from biodiversity hot spots and functional validation of indigenous crystal toxin genes against sugarcane insect pests.

From three districts of Rajasthan *viz*., Jaipur, Dausa and Sikar we collected 310 soil samples for isolation of *Bacillus thuringiensis*. The soil samples were collected along with information about the name of the place along with GPS Coordinates The soils were collected from crop land consisting of groundnut, cluster bean and bajra. In addition, soils were collected from barren and fallow land also. Soils were collected from spots that are not subjected to direct sun light because Bt spores are susceptible to UV light from sunlight. Four Bt isolates have been isolated after screening of 100 soils samples collected from Rajasthan. PCR screening of the isolates was done with *cry1*, *cry8* and *cry9* gene primers. Two isolates Raj 2 and Raj 31 amplified for *cry8* genes while amplification was not observed for *cry1* and *cry9* gene. Further sequencing would be carried out to assess the novelty of cry genes from the two Cry8 positive isolates.

Whole genome sequencing of isolates from Uttar Pradesh, Tripura and Western Ghats of Karnataka revealed the presence of novel cry toxin genes. The isolate UP 99 and UP 147 harboured novel genes belonging to Cry8 and Cry54 gene family respectively. The similarity of these novel toxin genes was 92.5 and 90.2 % respectively to Cry8 and Cry54 subfamily genes. Similarly, the Tri 19 isolate from Tripura was found to contain novel cry toxin genes with similarity of 92.5% to cry53 family gene. Two isolates Baj 113 and Baj 118 from western ghats of Karnataka harboured novel cry genes with similarity of 92.7 amd 92.5% Cry70Aa and Cry70Ba crystal toxin gene. The toxicity of these genes to pests of sugarcane and other crops needs to be explored.

(B. Singaravelu, C. Appunu, G.S. Suresha, C. Sankaranarayanan, K. Deva Kumar, P. Mahesh and T. Ramasubramanian)

Screening for novel genes in the transcriptomes of cane crambids for RNAi-mediated control

Transcriptomes of early shoot borer (ESB) and internode borer (INB) were sequenced and analysed for novel genes to serve as potential candidates for RNAi-mediated silencing. Through the RNAseq data the genes *viz*., chitin synthase A (*CHSA*), chitin synthase 1B (*CHS1B*), cytochrome P450 genes (*CYP9A68*, *CYP4*, *CYP9*, *CYP4AU10*, *CYP4AU11*), glutathione-S-transferase (*GST*), odorant binding protein (*OBP25*) and juvenile hormone acid methyltransferase (*JHAMT*) were identified as potential candidates for RNAi-mediated silencing. The RNAseq analysis revealed the expression of these genes at varying levels across the instars of both the crambids. The expression of *JHAMT*, which catalyses the conversion of inactive precursors of juvenile hormones (JHs) to active JHs in the final stages of JH biosynthesis in the corpora allata, was absent in the last larval instars of crambids. There was no or minimal expression of *JHAMT* in the fifth and sixth instars of INB and ESB, respectively. In order to confirm the dry lab results, wet lab work has been attempted. The expression profiles of above-mentioned genes were studied after isolating the total RNA from all the instars of the crambids using gene-specific primers. The q-RTPCR analysis showed that the levels of expression of genes across the instars were in corroboration with the transcriptome data obtained through RNA Seq. The *CHSA* gene, which is inevitable for the synthesis of chitin during moulting process has been identified as the appropriate candidate for RNAi both in ESB and INB. Since it was observed to be expressed in all the instars of both the crambids, it has been considered as an ideal candidate for RNAi-mediated approach. The double-stranded RNA was synthesized for *CHSA* and the application of which was resulted in morphological abnormalities leading to death of the insects.

(T. Ramasubramanian, S. Mohankumar (TNAU) and P.T. Prathima)

Prospects for conjunctive use of *Telenomus dignus* and *Cotesia flavipes* against internode borer

Mass multiplication of *Telenomus dignus*

Multiplication in glass tubes

In laboratory multiplication studies, when *Telenomus* adults were exposed to variable number of freshly laid lab-reared egg masses of internode borer to give different host egg: parasitoid ratios in glass tubes, parasitism was 100% within egg masses but with variable adult emergence (23.9-87.5).

Improvised method to scale-up production

a) Chimney method

In glass chimney method of multiplication, different host egg: parasitoid ratios of internode borer (INB) eggs and *Telenomus* adults were maintained. When *Telenomus* adults were exposed to freshly laid lab-reared INB egg masses, parasitisation was 100% among the egg masses and 74.37-100% parasitisation within eggs with variable adult emergence (49.11-95.0). In some egg masses, a few larvae emerged indicating incomplete parasitisation.

b) Cage method

When egg masses on leaf bits were exposed to the parasitoid at 10:1 ratio in plastic boxes enclosed in polyvinyl cylindrical cages with cloth top, 90.8-100% parasitisation within eggs in different batches and moderate to high adult emergence (48.18-69.46%) were observed.

Mass multiplication of *Cotesia flavipes*

Effect of larval age on parasitisation rates

Shoot rearing

When *Chilo sacchariphagus indicus* larvae of 15-, 20-, 25- and 30-days age were exposed to 20-25 adults of *C. flavipes* in a chimney for 12 hours and reared on sugarcane shoot bits, mean rate of parasitism decreased with age of the larvae.

Diet rearing

In a slightly different methods, when parasitized larvae from chimneys were reared on artificial diet in plastic boxes, maximum parasitization (44.0%) was observed on 20 d larvae followed by 15 d (20.0%) larvae.

Effect of larval age on parasitisation rates of *Cotesia flavipes* and extent of parasitism

Shoot rearing method			
Larval age(d)	% parasitization	Range	% parasitoid emergence
15	32.05	0.0-37.50	100
20	29.57	14.28-46.66	100
25	12.50	0.0-12.50	93.34
30	0.00	0.00	0.00
Diet rearing method			
15	20.00	0.0-20.00	94.29
20	44.00	10.0-46.66	100
25	0.00	0.00	0.0
30	0.00	0.00	0.0

Dispersal capacity of *Telenomus dignus*

In field experiments, sentinel host egg masses on leaf bits were placed in perforated plastic containers and suspended in the canopy of 7-month old crop. Containers were placed in different cardinal directions of five concentric circles of 5, 10, 15, 20 and 25 m radius and 1500 newly emerged (up to 24 h old) adults of *T. dignus* were released at the central point of the circles. Parasitism rates in sentinel egg masses decreased with increasing distance (5-20 m) and no parasitism was observed beyond 25 m distance. Parasitism was not observed in a control plot maintained at a distance with similar set up and no parasitoid release.

Parasitoid trapping with sentinel INB eggs

Leaf bits containing INB egg masses were placed in leaf axles of 6-9 month old crop of parasitoid release and control plots, collected 24 h later and examined for adult emergence. Among four trials, 20.0-33.3% parasitism was noticed in sentinel eggs kept in release plots compared to 0.0% in control plots.

Adult longevity at low temperature

Longevity of *Telenomus* adults maintained at low temperature (10°C) was longer (2-44 days) than that observed at room temperature (2-39 days).

Field evaluation of parasitoids against INB

Field tests with *Cotesia flavipes*

Field trials conducted with the parasitoid at different dosages and frequency showed positive evidence of higher parasitoid recovery in the release plots. In two trials, a dosage of 1000 and 2000 females/ha released twice at 30 and 45 d interval led to larval parasitism levels of 5.0 and 5.1%, respectively at 120 days after parasitoid release. In a third trial at a single dosage of 3000 females/ha, parasitoid recovery was 30.0% at 100 days after release.

Field evaluation of *Telenomus dignus*

Field efficacy of *T. dignus* was established in augmentative trials against internode borer. *Telenomus* released at a dosage equivalent of 1000 parasitoids/ha in the field reduced post-release INB level as opposed to an increase in INB level in control plot 30 and 60 d after release. At higher dosages of 2500-4500/ha released in a staggered manner too, INB incidence levels increased at a lower rate in release plots than in control plots.

Parasitization of *Telenomus* at SBIRC- Kannur

The natural occurrence of INB egg parasitoid, *Telenomus* at the Kannur Centre was studied. The natural parasitization from *Telenomus* ranged from 0- 68.54% (egg mass basis) and 0-93.45% (within the egg mass basis) were recorded on field-collected INB eggs. Inoculative field release of larval parasitoid, *Cotesia flavipes* was carried out in the germplasm crop and is being monitored for its establishment and biological control at the Kannur Centre.

(P. Mahesh and B. Mahendran)

Early detection of mechanism of resistance operating in sugarcane intergeneric hybrids against shoot borer, *Chilo infuscatellus* (Snellen) and internode borer, *Chilo sacchariphagus indicus* (Kapur) (Lepidoptera: Crambidae)

Screening of intergeneric sugarcane hybrids introgressed *Erianthus procerus* X commercial sugarcane varieties for resistance against sugarcane borers

Out of 89 genotypes screened for ESB, 40 genotypes were classified as tolerant (T), 35 genotypes as moderately tolerant (MT) and 12 genotypes as susceptible (S) to shoot borer. The ESB incidence among the 89 genotypes ranged from 1.54% to 56.61% and the nine genotypes, *viz*., GU 19-4, GU 19-7, GU 19-27, GU 19-28, GU 19-60, GU 19-61, GU 19-72, GU 19-78 and GU 19-85 recorded <5% ESB incidence. In a similar study, 89 intergeneric hybrids (IGHs) involving *Erianthus procerus* and Co canes were evaluated for resistance to the internode borer (*Chilo sacchariphagus indicus*), with 12, 24, and 53 genotypes classified as tolerant (T), moderately tolerant (MT), and susceptible (S), respectively. Besides, ten genotypes *viz*., GU 19-4, GU 19-22, GU 19-24, GU 19-43, GU 19-46, GU 19-49, GU 19-51, GU 19-62, GU 19-68, GU 19-78 and GU 19-88 showed <15% INB incidence. The impact of internode borer damage on the internode morphology of IGHs showed a significant reduction in both length and girth of the affected internodes across all genotypes. Despite the INB infestation, no significant reduction in internode length or girth was found in the IGH clones, *viz*., GU 19-4, GU 19-10, GU 19-24, GU 19-22, GU 19-38, GU 19-39, GU 19-43, GU 19-55, GU 19-77, and GU 19-85.

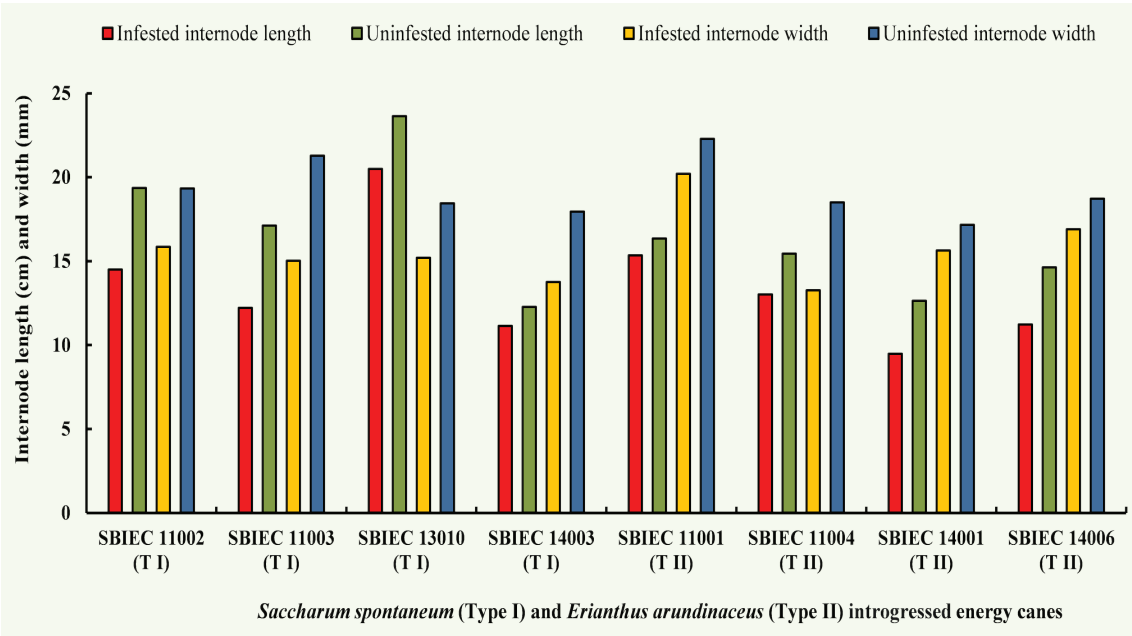
Field reaction of intergeneric sugarcane hybrids (*Saccharum spontaneum* x *Erianthus arundinaceus*) against sugarcane borers

Out of fifteen genotypes screened under field conditions for ESB, 12 were classified as tolerant (T) and three as moderately tolerant (MT), with ESB incidence ranged from 2.71 to 21.53%. Besides, five IGHs, CYM 08-922, CYM 07-981, CYM 04-388, CYM 09-167 and CYM 06-924 recorded 5% ESB incidence. In another field screening study for INB, 7, 5, and 3 IGH clones derived

from *S. spontaneum* with *E. arundinaceus* were graded as tolerant (T), moderately tolerant (MT) and susceptible (S), respectively. Among the entries, INB incidence and intensity ranged from 3.33 to 47.06% and 0.65 to 2.32%, respectively. Three IGH clones, CYM 08-922, CYM 07-981 and CYM 09-167 recorded 5-10% INB incidence with <1% INB intensity. Furthermore, INB-affected internodes become significantly reduced in their length and width invariably in all the genotypes, but there was difference in intensity among them. Several IGH clones, including CYM 06-212, CYM 07-649, CYM 07-678, CYM 09-521, CYM 09-1369, CYM 09-565 and CYM 10-172 were severely affected by INB, resulting in shortened internode length and width. However, internodes of CYM 06-924, CYM 07-981 and CYM 08-922 were comparatively less affected.

Influence of INB on the internode morphology of energycanes

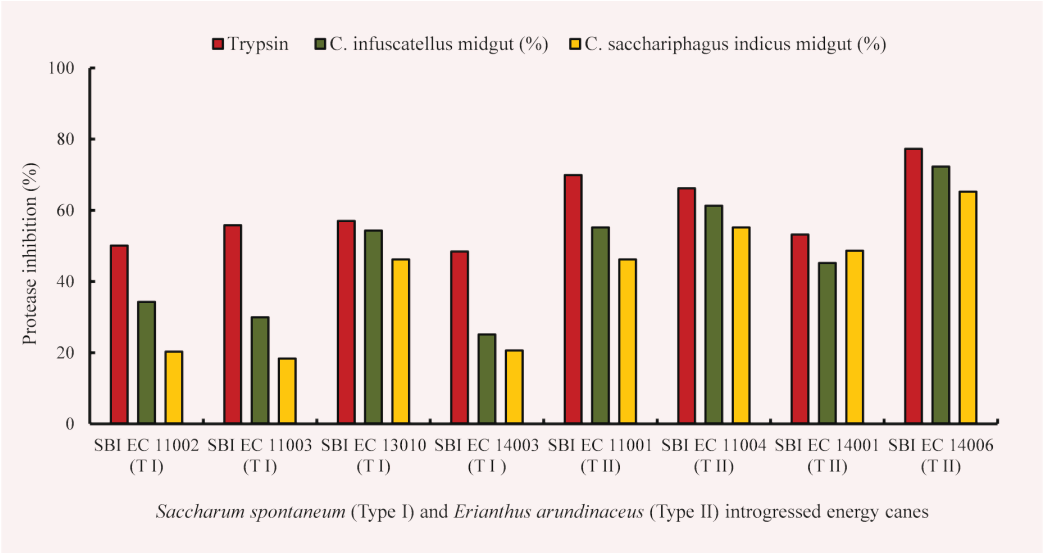
Internode borer infested internodes significantly reduced their length and girth invariably in all the energy canes (SBIEC 11003, SBIEC 13010, SBIEC 11002 and SBIEC 14003) and Type II (SBIEC 14006, SBIEC 11004, SBIEC 11001 and SBIEC 14001). However, it was comparatively higher in the Type I than the Type II. Despite the *C. sacchariphagus indicus* infestation, there was no significant reduction in internode length and girth observed in the SBIEC 13010 and SBIEC 14006 energycanes which were classified under the type I and type II categories, respectively.



Influence of INB on the internode morphology of energy canes

Quantification of protease inhibitors (PIs) of energy canes and their evaluation against mid gut proteases of borer pests

Protease inhibitors (PIs) were quantified from the apical meristem of Type I and Type II energy canes and evaluated for their inhibitory activity against commercial trypsin enzymes and midgut proteases of *C. infuscatellus* and *C. sacchariphagus indicus*. Results showed that protease inhibitors were present in all energycanes, but the quantity differed significantly among them. Trypsin inhibition was significantly higher in the Type II energycanes, with >65% inhibition, compared with >52% in the Type I energy canes. The results clearly showed that the PIs from Type II energy canes SBIEC 14006 and SBIEC 11004 effectively inhibited the midgut proteases of *C. infuscatellus* and *C. sacchariphagus indicus*. Correspondingly, Type I energy cane PIs were not enough to inhibit the midgut protease enzymes of *C. infuscatellus* and *C. sacchariphagus* indicus, with the exception of SBIEC 13010. Among two types of energy cane, SBIEC 14006 and SBIEC 11004 under the Type II category and SBIEC 13010 under the Type I category had a greater potential to inhibit the midgut protease enzymes of *C. infuscatellus* and *C. sacchariphagus indicus*.



Quantification of protease inhibitors (PIs) of energy canes and their evaluation against midgut proteases of borer pests

(M. Punithavalli and K. Mohanraj)

Standardization of diet based bioassay for white grub

Suitability of different diet combinations

Two types of diet combinations were evaluated for rearing of *Holotrichia serrata*. The mean survival period of *H. serrata* from egg lay to adult on diet 1 ranged between 120- 220 days with a mean of 178.7 (n=7). The mean larval period was178.7 (n=7) and the pupal period was 15.28. In diet 2 the mean larval period was 206.5 days. Egg lay to adult emergence was ranged between 165-247 days. The mean pupal period was 22.1. Weight gain of grubs that survived longest in the two groups indicated a typical pattern of steep increase followed by gradual decline. Overall growth ratio was highest in diet 2 but not significantly different.

Diet incorporation method of bioassay:

Mortality in first instar bioassays

Diet incorporation method of bioassays were conducted with different media containing the spore-crystals and applied at 10^9cfu/ml spore strength. All the treatments showed significant differences in the mortality treated with the Bt-62 spore-crystal complexes using the different media compared with control. The highest mortality (73.33%) was shown in the sugarcane trash media containing Bt-62 spore-crystals followed by sugarcane juice (63.33%)

Mortality in second instar bioassays

When it was tested against 2nd instar with the Bt-62 spore-crystal mixture of cry8Sa1 @ 20.0 ppm. The highest mortality (58.33%) was shown in treated grubs however, no mortality was observed in untreated grubs.

Life cycle and larval development on different diet materials

Food material	Survival period (d) Egg- Adult	Larval period (d)	Pupal period (d)	Longevity
Diet 1	120.0 – 220.0	178.7	15.28	12.2
Diet 2	165.0 - 247.0	206.5	22.1	13.4

Survival and growth rate of *Holotrichia serrata* grubs on different food materials

Food material	Survival period (d)		Mean initial wt (g)	Mean final wt (g)	Overall growth ratio
	Mean	Range			
Carrot	33.90	1.0-113.0	0.0342	0.1031	3.014
Diet I	69.78	1.0 -236.0	0.0382	0.3410	8.926
Diet II	88.14	1.0 - 296.0	0.0326	0.4132	12.674

Diet incorporation bioassay for borer pests

Diet incorporation method of bioassays was conducted with the spore-crystals mixture of cry9Eb @ different dosages (0.5ppm to 100 ppm) against internode borer and early shoot borer. Uncontaminated diet serving as control and the mortality of larvae was observed at 24 h interval. Larvae suffered mortality 1 day after treatment (DAT) and substantial mean mortality rates (100%) at different dosages, particularly at higher levels, were significantly higher than that in control.

(P. Mahesh and B. Singaravelu)

Bio-ecology of crown mealybug and its management in association with *Pokkah boeng* in sugarcane

Biology, ecology, host plant resistance, biocontrol and toxicological aspects of the crown mealybug *Phenacoccus saccharifolii* were studied. The life cycle of male and female insects lasts for 21-25 and 36-42 days, respectively. The fecundity of *P. saccharifolii* varied between 120 and 498 eggs with the mean value of 281 ± 90 eggs/female. The day-wise number of eggs laid by the females was the highest on the second day of their oviposition. The fertility of the eggs was observed to be in the range of 63.2-93.0% with the average value of 79.1 ± 7.8%. Age-specific fecundity tables were also constructed for the *P. saccharifolii*. The population of mealybug was expected to be doubled within a week time with weekly multiplication rate of around 2.0. The net reproductive rate was estimated to be 25.7 with mean generation time of 32.5 days in 2024.

The sugarcane mealybug *P. saccharifolii* was observed to be parasitized by the members of the hymenopteran family Encyrtidae. *Leptomastix sylvae* Noyes & Hayat, 1994 (Hymenoptera: Encyrtidae), *Aenasius hayati* Manickavasagam, 2012 (Hymenoptera: Encyrtidae) and *Eotopus beneficus* (Shafee) (Hymenoptera: Encyrtidae) were the encyrtids identified to parasitize the mealybug *P. saccharifolii* across the different locations of Tamil Nadu and Coimbatore, in particular. *Promucidea unfasciativentris* Girault, 1917 (Hymenoptera: Eriaporidae) and *Prochiloneurus pulchellus* Silvestri, 1915 (Hymenoptera: Encyrtidae) were also found to be emerged from the mummified mealybugs. However, *P. unfasciativentris* and *P. pulchelus* were hyperparasitoids of the encyrtids attacking mealybugs. The extent parasitism was recorded for one year starting from August, 2023 to July, 2024 by collecting the mealybug populations from ICAR-Sugarcane Breeding Institute, Coimbatore at weekly interval. The extent of parasitism by all the species of parasitoids was in the range of 5.6-39.7% with peak parasitism during first fortnight of August to first fortnight of September. The extent of parasitism by *L. sylvae* alone accounted for 34.7-78.4% of the total parasitism by all the species of the parasitoids recorded in this study with an average of 62.9%.

A total of 291 clones maintained at DUS and NAG Collections were screened for their reaction to *P. saccharifolii* for two consecutive cropping seasons when the mealybug incidence had crossed 50% mark in the susceptible check variety CoV 09356. The mealybug incidence on CoV 09356 was 78.87 and 64.82% during 2023 and 2024 cropping seasons, respectively. Out of the 291 clones screened, 61 showed wide variation in the level of incidence of the mealybug between the two cropping seasons. Hence, the data pertaining to those 61 clones were eliminated from this study. Out of the remaining 230 clones that were consistent in their reaction to the mealybug incidence in both the seasons, the clones *viz*., CoM 9516, CoLk 14204, IG 91-1100 and CoV 09356 had the mean incidence of more than 70%. As many as 61 clones had 10.1-20.0% incidence of the mealybug inducing relatively known varieties *viz.* CoA 92081, Co 99004, Co 05009, Co 0118, Co 0212, CoA 08323, Co 09004, Co 05011, Co 11015, Co 15023 and Co 18009 did fall under this category. A large number of clones (88) were observed to have 0.1-10.0% incidence of *P. saccharifolii*. The important clones *viz*., Co 86032, Co 06030, CoV 92102 and CoLk 94184 had 3.22, 3.84, 6.08 and 9.90% incidence of the mealybug, respectively. A total of 27 clones were free from the attack of the mealybug in both the cropping seasons. These clones would serve as sources of resistance for developing resistant varieties against *P. saccharifolii*. The Type II energycane SBIEC 11004 was one among the clones that was observed to be free from the incidence of the mealybug. Extensive surveys in the farmers' fields during the past three years (2022-2024) revealed that CoV 09356 succumbs more to mealybug as compared to the popular cane variety Co 86032. A gradual increase in the area under CoV 09356 in the recent years could be a possible reason for widespread occurrence of the mealybug in the State of Tamil Nadu, India. Granular insecticides *viz*., carbofuran 3% CG, cartap hydrochloride 4% GR, chlorantraniliprole 0.4% GR, fipronil 0.3% GR, fipronil 0.6% GR and chlorantraniliprole 0.5% + thiamethoxam 1% GR were evaluated for their efficacy against the mealybug for two seasons under pot-culture experiments. All the granular insecticides were observed to be effective in bringing down the mealybug populations to a greater extent after two applications at fortnightly intervals. Among the granular insecticides

evaluated, cartap hydrochloride 4% GR, thiamethoxam 1% + chlorantraniliprole 0.5% and carbofuran 3% CG were observed to be superior with more than 85% reduction over control after two applications.

(T. Ramasubramanian, R. Selvakumar and B. Singaravelu)

Isolation, characterization and utilization of entomopathogenic fungi for pest management in sugarcane

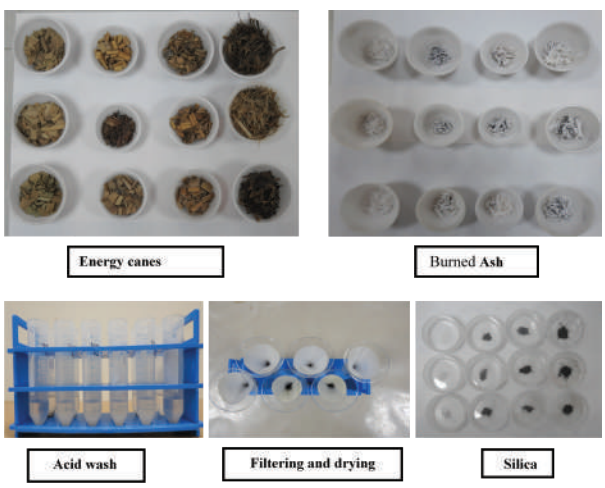
Isolation (from soil), characterization (through cultural and molecular means) and evaluation of entomopathogenic fungi (against major pests of sugarcane) were attempted during the period under report. A total of 319 soil samples collected from 40 different locations of the country were used to isolate entomopathogenic fungi (EPF). A total of 59 EPF isolates were obtained from the 319 soil samples screened for the presence of EPF if any, by *Galleria*-baiting method. Out of the 59 isolates, 46 were *Beauveria bassiana* and the rest (13) were *Metarhizium anisopliae*. The EPFs were characterized by both cultural and molecular means. The radial growth and sporulation of EPFs on solid media were recorded. The radial growth after 21 days of inoculation was in the range of 4.03 - 7.83 cm across the *B. bassiana* isolates. The lowest and the highest radial growth were recorded for SBI_TNMDU_Bba and SBI_TNIGR_Bba isolates, respectively. Similarly, for *M. anisopliae*, the radial growth was in the range of 7.0 cm for SBI_TNTPR4_Ma to 7.67 cm for SBI_APDWM_Ma. The spore count was in the range of 1×10^{7}/mL (SBI_MPIDR_Bba) - 8×10^{10}/mL (SBI_UPKPR_Bba) and 1.42×10^{8}/mL (SBI_TNAKL_Ma) - 8×10^{9}/mL (SBI_APDWM_Ma) for *B. bassiana* and *M. anisopliae* isolates, respectively. The fungal DNA barcodes established in the study to confirm the identity of isolated EPFs were deposited in the GenBank of NCBI. Besides, isolation and characterization, the EPFs were tested for their virulence against white grub, fall armyworm, early shoot borer, internode borer and crown mealybug. A total of 18 EPF isolates (*B. bassiana*-12 + *M. anisopliae*-6) were recorded to be highly virulent against *Holotrichia serrata* with 70-90% mortality of the white grub. Besides, another 19 EPF isolates (*B. bassiana*-14 + *M. anisopliae*-5) were recorded to be highly virulent against fall armyworm *Spodoptera frugiperda* with more than 70% mortality. The EPFs were also evaluated against the Crown mealybug, *Phenacoccus saccharifolii*. A total of five *B. bassiana* isolates were observed to be highly virulent against *P. saccharifolii* with more than 70% mortality. A total of 11 *B. bassiana* and five *M. anisopliae* isolates were recorded to be highly virulent with 70-100% mortality against the ESB. Further, seven *B. bassiana* and four *M. anisopliae* isolates were observed to be highly pathogenic to INB with 70-100% mortality of third instar larvae.

(T. Ramasubramanian, P. Malathi and B. Singaravelu)

Relationship between the silicon content in *Saccharum* and *Erianthus* species with resistance to sugarcane borers

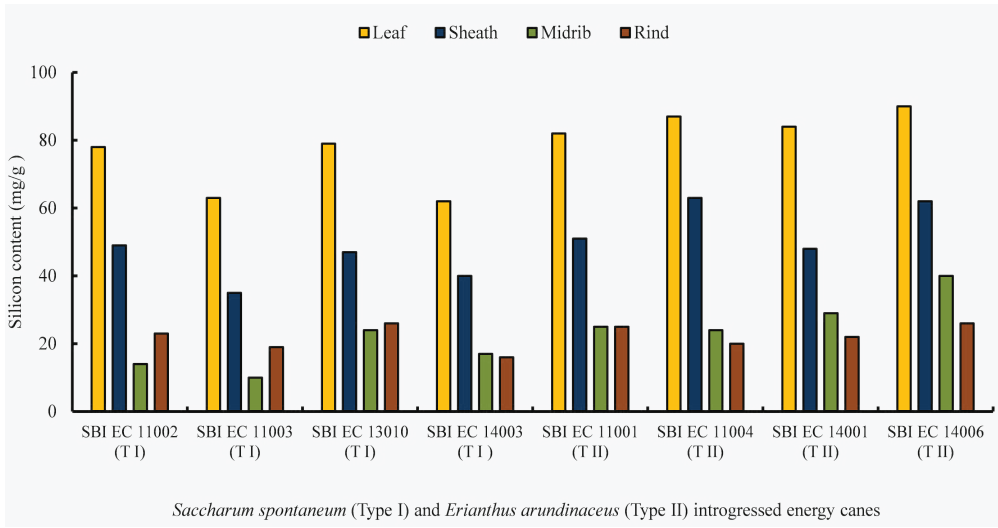
(i) Standardization of protocol for the quantification of silicon content in sugarcane

Silicon profiling was done in the preferred feeding sites of sugarcane borers, such as the leaf, leaf sheath, midrib and rind of the randomly selected 5-month-old energy canes. The sampling for silicon in the leaf and midrib was done on the third opened leaf of the plant, specifically in the middle 30 cm of the total leaf. Similarly, the leaf sheath of third leaf' was sampled for silicon, measuring from the bottom to 15 cm of the entire leaf sheath. To measure the silicon content of the rind, the middle internode segment at approximately 15 cm of the total cane was selected. A total of ten plants per energy cane were selected for silicon analysis, with five replications and two plants used in each replication. The samples were cut into small pieces and kept in the hot air oven at 65 °C for a week. 1g of each energycane oven-dried sample was taken in a crucible and kept in the muffle furnace at 675 °C for 24 hrs. The resulting ash was washed 5–10 times with 5 ml of an acid mixture (1.5 M HNO3 and 3.71 M HCL) and the supernatant was poured off to obtain undissolved ash. The suspension resulting from the final ash was filtered using an acid hardened ash-less filter paper (541, Whatman, UK) and washed five times with double distilled water. The filter paper containing acid-insoluble ash was then ashed in a muffle furnace, and the ash residue was taken as silica.



(ii) Silicon profiling in the Type I and Type II energy canes

Profiling of silicon at the preferential feeding sites of sugarcane borers *C. infuscatellus* and *C. sacchariphagus indicus* on the Type I and Type II energy canes is given in Figure. Silicon content was significantly higher among the plant parts in the order of leaf > leaf sheath > rind > midrib invariably in all the Type I energy canes. The same pattern was observed in Type II energy canes also, with the exception that the rind sections had a lower silicon content. There were no noticeable differences in silicon content between the midrib and rind in all the types of energy canes. Furthermore, the silicon content was highest in all parts of the Type II energy cane SBIEC 14006, followed by SBIEC 11004 and SBIEC 11001, while it was lowest in SBIEC 14003 and SBIEC 11002 of the Type I energycanes.



Profiling of silicon at the preferential feeding sites of sugarcane borers

(iii) Quantification of silicon in the popular sugarcane varieties and their relationship with ESB and INB incidence

Silicon quantification was done on the leaf sheath and rind, which are preferred feeding sites of tissue borer in sugarcane. Results revealed the inter-varietal differences of silicon in the plant parts of the selected varieties. The leaf sheath and rind silicon content in all the varieties ranged from 23 to 43 mg/g and 12 to 19 mg/g, respectively. Among the varieties studied, the silicon content in the leaf sheath was the highest in the variety Co 06030 (43 mg/g) followed by Co 06022 (38 mg/g) and Co 0238 (36 mg/g). However, the lowest silicon content was observed in Co 11015 (22 mg/g) and Co 09004 (24 mg/g). A similar trend was followed in rind silicon in all the varieties. A simple correlation analysis was done to establish the relationship between rind and leaf sheath silicon content with ESB and INB incidence. Leaf sheath silicon content was negatively correlated with ESB and INB incidence. But there was no correlation found between rind silicon with borer incidence.

(M. Punithavalli, A. Vennila and C. Jayabose)

All India Coordinated Research Project on Biological Control

Entomology: Parasitization on sugarcane internode borer (INB), *Chilo sacchariphagus indicus* (Kapur) was recorded during August 2023-July 2024 by collecting a total of 1583 larvae from the farmers' fields. The number of larvae collected in each month varied between 52 in April 2024 and 224 in October, 2023 with an average of 135/month. The collected larvae were reared in sugarcane shoots until pupation. The INB larvae were found parasitized by the braconid endoparasitoid *Cotesia flavipes* Cameron (Hymenopters: Braconidae). When we look at the month-wise parasitism, it was in the range of 0.0 (August, 2023)-3.6% (October, 2023) with an average of 1.61%/month. The number of adults emerged out of the parasitized larvae were in the range of 6-54 with an average number of 30/larva. We have also recorded the level of parasitization on early shoot borer, *Chilo infuscatellus* Snellen during March-July 2024. The ESB larvae were found parasitized by the tachinid *Sturmiopsis inferens* (Tachinidae: Diptera) to the extent of 10.2% in

March, 2024. However, no parasitism was observed during April-June 2024. The cadavers of *Pyrilla perpusilla* collected from sugarcane fields of Indore were found infected with the EPF *Penicillium oxalicum*. It has been both culturally and molecularly characterized. The fungal DNA barcode has been submitted in the GenBank of NCBI.

Pathology: Efficacy of settling production with various agro-inputs against fungal diseases

Under this study, settlings were raised from single bud setts of smut infected Co 96007 and wilt infected Co 86032 and Co 11015 were subjected to mechanized sett treatment with azoxystrobin fungicide and its combination with bacterial antagonist *Paenibacillus alvei* followed by planting in substrate mixed with bioformulations of *Paenibacillus alvei* and *Trichoderma* spp. individually and in combination. Results revealed that, the sett treatment with fungicide followed by planting in the substrate with bioformulations at the time of planting was found to be effective in improving the germination and settling vigour. Similar experiment against red rot conducted with CoC 671 along with grain inoculum indicated that there was no disease expression even in control. Hence settling production after treatment with fungicide along with addition of bioformulations in the substrate or spot application at the time of planting was found to be highly helpful to protect the crop from both sett and soil-borne inoculum of fungal diseases.

(T. Ramasubramanian and P. Malathi)

Externally Funded Project

Impact of climate change on crambid borers of sugarcane and ways of mitigation (DST-SERB-TARE)

Impact of temperature, relative humidity and CO_2 was assessed on the growth and reproduction of the Crambid, the early shoot borer upon culturing the population under ambient temperature (27 °C) RH (75%) and 450 ppm of CO_2 for a generation in sugarcane shoots. The growth and reproductive characteristics *viz*., the duration of egg, larval, pupal periods, longevity of adults and fecundity were recorded. We have also constructed an age-specific fecundity table for ESB cultured under ambient temperature, RH and CO_2 level. The egg, larval, pupal periods were recorded to be 4-7, 18-24 and 3-5 days, respectively. The adult longevity was in the range of 4-8 days. The pre-oviposition, oviposition and post-oviposition periods were observed to be 1-3, 2-4 and 0-3 days, respectively. The net reproductive rate and generation time were deduced to be 37.6 and 28 days, respectively.

(T. Ramasubramanian and Sheela Venugopal (TNAU))

Public–Private Partnership Project

Cloning expression and functional toxicity assay of *cry1D*, *cry2Af* and *vip3Bb* toxin genes from *Bacillus thuringiensis* isolate against Bt-resistant pink bollworm and other important lepidopterans.

Under the collaborative project with Rasi Seeds Pvt Ltd, Attur, we have cloned cry1D, cry2Af and Vip3Bb in suitable expression vectors for conducting bioassay against Bt-resistant pink bollworm and other important lepidopterans. In this project we have cloned all the three genes and expressed in suitable expression vector. One of the expressed toxin was found effective against Bollgard II resistant pink boll worm. The full length and truncated versions of the effective gene was used for transformation of tobacco and the bioassay with transformed tobacco was effective against the pink boll worm. As the project is covered under confidentiality agreement with Rasi Seeds Pvt Ltd, the final report will be submitted after resolving any pending IP formalities coming out of this collaborative project. The project has been completed successfully and Rasi Seeds Pvt Ltd, Attur is in talks with ITMU/AgriInnovate for finalising formalities for commercialisation.

(B. Singaravelu, G.S. Suresha, C. Appunu, and P. Mahesh (ICAR-SBI)
S. Mohan, M. Saravanakumar, A. Nixon Prabhu, M. Dinesh and M. Venkatachalam
(M/s. Rasi Seeds Pvt. Limited, Attur)

5.3.3. Nematology

Basic and applied studies of sugarcane phytonematodes and entomopathogenic nematodes

In-vitro mass production and formulation of Entomopathogenic nematodes (EPN) and its bioefficacy against white grubs

Monoxenic culture of EPN

Eight EPN isolates *Heterorhabditis indica* SBITND78, *H. bacteriophora* SBITNHB *S. surkhetense* SBIP3, *S. thermophillum* SBIH1, *S. siamkayai* SBITNT1, *S. glaseri* SBILN1, *S. abbasi* and *S. carpocapseae* SBIP2 were attempted for monoxenic culturing of EPN with specific bacteria.

Liquid culturing of EPN and its bioassay against Galleria larvae

Mass production of four *Steinernema* spp. (*Steinernema surkhetense* SBIP3, *S. thermophilum* SBIH1, *S. siamkayai* SBITNT1, *Steinernema* spp. SBIUP96) was attempted in monoxenic liquid culturing and successful nematode mass production was observed in the liquid media. The multiplication of EPN in liquid culture was differed with EPN species. *S. surkhetense* SBIP3 and *Steinernema* spp. SBIUP96 obtained maximum yield at 8th day. *S. thermophilum* SBIH1 obtained maximum yield in 15 days and *S. siamkayai* SBITNT1 obtained maximum yield in 21 days. Under bioassay studies, all the EPN isolates caused 100 percent mortality of *Galleria* larvae at 72h.

Comparison of *in-vivo* and *In-vitro* cultured EPN against *Galleria* larave

Comparison of two EPN isolates (*S. surkhetense* SBIP3 and *S. siamkayai* SBITNT1) cultured on *in-vivo* and *in-vitro* methods were tested against *Galleria mellonella* larvae with different dosages (5IJs/larva, 25Ijs/larva,50IJs/larva and 100Ijs/larva) and the mortality and IJs yield recorded. Mortality of the *Galleria* larvae observed both in *in-vivo* and *in-vitro* cultured EPN and it was ranged between 60 to 100%.

Commercialization of ICAR- SBI EPN Biopesticide Formulation

During the period, the ICAR-SBI EPN Biopesticide formulation technology has been commercialized to five biopesticide companies with a license fee of Rs. 10 lakhs. As per MOU, trainings were given to the concerned company personnels.

Maintenance of EPN & symbiotic bacterial cultures

Seventy-eight EPN strains belongs to tropical (49) and subtropical (29) regions are being maintained in the culture collection and 45 symbiotic bacteria belongs to *Photorhabdus* spp. (26 Nos.) and *Xenorhabdus* spp. (19 Nos.) are also being regularly sub cultured and stored in glycerine.

(C. Sankaranarayanan, K. Hari and B. Singaravelu)

All India network project (AINP) on white grubs and other soil arthropod pests management of white grubs through EPN

Supply of EPN cultures to AINP on white grub centers: ICAR Sugarcane Breeding Institute (ICAR-SBI) Coimbatore was approved by the competent authority as a voluntary center under All India Network Project on Soil Arthropod Pests during December 2023. Five EPN *Heterorhabditis indica* SBITND78, *H. bacteriophora* SBIP5, *Steinernema surkhetense* SBIP3, *S. thermophillum* SBIH1 and *S. siamkayai* SBITNT1 were mass produced and formulated in talc and supplied to 1. Assam Agricultural University, Jorhat for field trial against white grub on potato; 2. RARI Centre, Durgapura, Rajastan for field trial against white grub on groundnut and 3. UAS, GKVK, Bengaluru Centre for sugarcane white grub control. Mass production and formulation of EPN is being continued for supply to other centres as per the technical programme.

Bioassay of EPN isolates against 1st instar white grub *Holotrichia serrata* under laboratory and pot culture conditions

Bio assay of five EPN tested against 1st instar white grub revealed that, all the EPN caused mortality of the white grub and it was ranged between 25 to 100%. Under pot culture conditions, with Sugarcane cv. Co11015, EPN *Heterorhabditis indica* SBITND78 caused 80% mortality of white grubs.

Evaluation of EPN isolates against white grub on sugarcane under field conditions

A field trail was conducted in a farmer's field at Thalavadi, Tamilnadu to test the efficacy of five EPN, *H. indica* SBITND78, *H. bacteriophora* SBIP5, *Steinernema surkhetense* SBIP3, *S. thermophillum* SBIH1 and *S. siamkayai* SBITNT1 against white grub *Holotrichia serrata* third ratoon sugarcane cv CoVC 14061. Totally seven treatments and four replications in RBD maintained. The observation on initial grub count and 15 days after treatment was recorded. All the treatments caused mortality of the grubs, except control treatment. Among the EPN, *H. indica* SBITND78 recorded 78 percent reduction of grub population compared to the control plants which was on a par with Imidacloprid treatment. Dead EPN infected grubs observed in all EPN treated experiments.

(C. Sankaranarayanan, B. Singaravelu and P. Mahesh)

Externally Funded Project

Artificial intelligence powered diagnostic kit for real-time monitoring of nematode pests of sugarcane (TARE -DST-SERB)

Image data set

A total of 340 soil/root samples from sugarcane rhizosphere were collected and processed. Twenty-four hours after incubation, the nematodes collected in the petri dish were killed and fixed in 4% formaldehyde. The nematode images at 100x magnifications were captured

under camera built-research compound microscope. The image set was organized in separate folders for images of root-knot nematode, lesion nematode, lance nematode, stunt nematode and spiral nematode. The nematode images of free-living, insect parasitic and other plant-parasitic nematodes are saved in a folder named 'other nematodes'.

AI-Deep learning algorithm

The nematode images captured through varied resolution sizes and angles were normalized using an image enhancement technique. Deep learning algorithm using Convolution Neural Network Operations was developed using the normalized nematode images data sets. The ability of Deep learning architecture to discriminate each nematode images are now being improved by introduction of selectivity function. Testing of deep learning algorithm for its accuracy using the validation images is also in progress.

(C. Sankaranarayanan (Mentor), D. Suryaprabha (Nehru Arts and Science College, CBE) and N. Seenivasan (TNAU, CBE))

5.4. Statistics & Economics Section

Economic and statistical studies in sugarcane and sugar production system

Sugarcane based Agri-Business Incubator (SBI-ABI)

SugarcaneEdge has installed several instruments, including a vacuum oven, tray dryer, HPLC column, wine refractometer, and other small equipment for pilot-scale production and the development of novel food products. Three incubatees joined *SugarcaneEdge* to work on the development of jaggery based chocolates and novel sweets, sugarcane-based juice powder and organic jaggery, respectively. Presentations and demonstrations on sugarcane - based agripreneurship were carried out at Avinashilingam Deemed University, Coimbatore on 28.6.24, at Agri-Intex fair, Coimbatore during 11-15 July 2024, at District collector's office and at TNAU Farmers day during 24-29 September 2024. Progressive farmers, start –ups, entrepreneurs and delegates from various institutions and policy makers have visited ABI.

Dr. N.Manickam, CMD, Sakthi Sugars Ltd., visited ICAR-SBI Agribusiness Incubation Centre (SugarcaneEdge®) for a discussion on licensing technologies for commercialisation

As part of the programme, a Memorandum of Agreement (MoA) was signed to provide co-incubation, technical support, lab facilities, networking, value-added services, and co-networking opportunities. SugarcaneEdge also undertook a technical evaluation of the progress of Vattam Agro, Chennai, on development of sugarcane dietary fibre based human and animal supplements for healthy diets. . The evaluation found that the supplements developed by the entrepreneur has great potential as fibre supplements to animal and human beings.

National level Stakeholder Meet (UTSAV-2024) organised by SugarcaneEdge® startup (Celebrating Farmers Edge International Private Limited)

(P. Murali, K. Hari, G.S. Suresha and D. Puthira Prathap)

Network project on "Production systems, Agribusiness and Institutions": Impact assessment of agricultural technology

Data on variety Co 11015 were collected to study the technical feasibility and economic viability of the cultivating three crops in two years at Sakthi Sugars-unit-II, Sivaganga district of Tamil Nadu. To assess the impact of Soil Moisture Indicator (SMI) on water conservation, a study was conducted at Varanasi district of Uttar Pradesh. About 100 farmers who used SMI for different field crops such as wheat, Tomato, vegetables and *etc.* during 2021-22, opined that they save to two irrigations due to usage of SMI per crop cycle. In general, cane harvesting is carried out a well-drained soil, on the surface and underground for easy harvesting and good sugar recovery. Hence, a few sugar mills are using SMI for measuring soil dryness and cane harvesting (cutting) order is issued accordingly. The field level impact studies in Tamil Nadu (tropical state) and Uttar Pradesh (sub-tropical state) have provided a useful insight on SMI. Proper utilization of SMI has benefited sugarcane growers by reducing its cost of production by Rs. 5800/ ha, volume of water consumed reduced from 258.45 m3/ha to 221.52 m3/ha, units of electricity utilized from 1680 Kw/ha to 1440 Kw/ha. However, farmers' level of adoption of technologies is low due to lack of information, and concerns about effectiveness of the technology. Another concerning factor can be the tariff-free electricity which may reduce the perceived need to adopt the water efficient technologies. Therefore, it is essential to create awareness among farming community about the potential long-term benefits of adopting SMI and the rising threat of groundwater depletion. The

impact of the variety Co 0238 on sugarcane value chain management was prepared and submitted for review and suggestions.

(P. Murali, D. Puthira Prathap and K. Hari)

Statistical tool for analysing crop science data: An expert software system

Collected inputs from the institute's scientific staff, particularly from the breeding unit, regarding their requirements for statistical tools. The required analyses include descriptive statistics (minimum, maximum, mean, median, standard deviation, skewness, kurtosis, coefficient of variation [CV]), correlation, regression analysis, genetic variability analysis, heritability, path coefficient analysis, cluster analysis, principal component analysis (PCA), AMMI (Additive Main Effects and Multiplicative Interaction) ANOVA, genotype + genotype × environment (GGE) Biplot analysis, chi-square test, Bartlett's test for homogeneity of variances, multi-trait and multi-locational analyses (i.e., groups of experiments or pooled ANOVA), and many more. These statistical methodologies have been collected for statistical software. Conducted a bibliographic analysis of existing statistical softwares, evaluating their usage and limitations.

Furthermore, R programmes for pooled analysis of variance using completely randomized design (CRD), randomized complete block design (RCBD), Latin square design (LSD), split plot design (SPD), and strip plot design (StPD) have been developed as backend codes for integration into the software. Each function provides the following outputs: (i) Individual ANOVA tables based on independent analyses for each location or year; (ii) Homogeneity testing of error variances among distinct locations or years using Bartlett's Chi-Square test; (iii) Application of Aitken's transformation to the response variable if Bartlett's test indicates significance, otherwise using the data as such without transformation; (iv) Combined analysis to derive a pooled ANOVA table; and (v) Multiple comparison tests such as Tukey's HSD (Honestly Significant Difference) test, Duncan's Multiple Range Test (DMRT), and the Least Significant Difference (LSD) test for treatment comparisons. A single experiment conducted in one location and season may yield limited conclusions due to potential variations under different environmental conditions. In agricultural research, interactions like treatment × location and treatment × season are crucial. Analyzing a series of experiments across diverse conditions enables more generalized and reliable recommendations. These R codes facilitate pooled analysis of experiments conducted over multiple seasons or locations, designed to assess treatment interactions with environmental factors (e.g., location and season) using various experimental designs. By expanding the scope of experimental conclusions, these codes empower researchers to derive robust and widely applicable recommendations.

(Vinayaka, P. Murali, P. Rama Chandra Prasad (IIIT-Hyderabad) and P. Govindaraj)

5.5. Extension Section

Transfer of sugarcane technologies

Utilization of extension methods and media for effective transfer of sugarcane technologies

a. 22nd Sugarcane R&D Workshop of Southern Karnataka

ICAR- Sugarcane Breeding Institute had organized the 22nd Sugarcane Research & Development Workshop of Southern Karnataka at B.N.Bahadur Institute of Management Sciences, Manasagangothri, University of Mysore, Mysuru , during 20-21 June 2024 and discussed the following topics.

i. Review of action taken on the recommendations of the previous workshop

ii. Managing drought & measures to improve irrigation water use efficiency

iii. Interventions for improving sugarcane yields in Southern Karnataka

iv. Review of mechanization initiatives in the region including mechanical harvesting

v. Varietal position in sugar factories, Performance of new sugarcane varieties & AICRP (S) Varietal trials

vi. Sugarcane seed nursery programme

Besides discussion on these topics, an open- interactive session and a Special lecture on *'Why should sugarcane farming be the preferred choice of farmers of Southern Karnataka?'* was delivered during the workshop.

Coromandel Sugars Ltd.., Makavalli and M. Visvesvaraya Sugarcane Research Centre, Mandya of S.Nijalingappa Sugar Institute, Belagavi jointly hosted the workshop. About 250 delegates comprising scientists from ICAR-Sugarcane Breeding Institute, Coimbatore, UAS-Bangalore & S..Nijalingappa Sugar Institute , Cane Development personnel from various sugar factories, officers from the Department of Agriculture, and other Cane Development organizations in Karnataka had participated in the workshop.

22nd Sugarcane R&D workshop of Southern Karnataka

Participants at the 22nd Sugarcane R&D workshop of Southern Karnataka

b. Workshop on 'Management of Crown mealybug and *Pokkah boeng* in Sugarcane'

ICAR – Sugarcane Breeding Institute, Coimbatore organized a 'Workshop on Management of Crown Mealy Bug and *Pokkah boeng* in Sugarcane' in association with Society for Sugarcane Research & Development (SSRD), on 12 November 2024. In the recent months, reports of incidence of Crown Mealy Bug (CMB) and Pokkah Boeng (PB) in sugarcane in certain districts of Tamil Nadu have been on the rise. In view of this, this workshop was organized for the benefit of sugarcane development personnel belonging to the districts of Villupuram, Cuddalore, Kallakurichi, Ariyalur, Perambalur, Namakkal, Thanjavur, Tiruchirappalli, Tiruvannamalai, Dharmapuri and Erode.

Workshop on 'Management of Crown mealybug and Pokkah boeng in Sugarcane'

Participants of the Workshop on 'Management of Crown mealybug and Pokkah boeng in Sugarcane'

c. Trainings/Exposure visits/Personal advisories

1. Trainings organized

a. Sponsored /Intra/Inter-state Training Programmes for Farmers and Cane Development Personnel

i. Training on '*Scientific Sugarcane Cultivation*' (***TSSC***) for the sugarcane farmers of Miraj Taluk, Sangli district, Maharashtra, during 22-23 February 2024

ii. A Training programme on Improving Sugarcane Productivity (**TISP**-2024) was conducted on 28 March 2024 for 25 Scheduled Caste sugarcane farmers of Andhra Pradesh.

Participants of TISP -2024

iii. **Training** on '**Sugarcane Production**' (**TSP-24**) for the sugarcane farmers of Palus Taluk, Sangli district, Maharashtra, during **19-20 December 2024.**

Participants of TSP-2024

2. One-day Trainings/Exposure Visits/Personal/ Customized Advisories

The details of one-day training programmes for farmers, exposure visits for students and customized , personal advisories by the Institute are given in the table.

One-day Trainings/Exposure Visits/Customized Advisories

S.No.	Month (2024)	One-day Trainings		Exposure Visits		Personal, Customized Advisories		States
		No.	Participants	No.	Participants	No.	Participants	
1	January	4	144	14	1346	3	8	TN, Maharashtra, Telangana, Puducherry & Kerala
2	February	3	68	19	1408	9	18	TN, Kerala, Karnataka, Maharashtra, Madhya Pradesh & Andhra Pradesh
3	March	-	-	11	739	9	16	TN, Karnataka, Maharashtra, Meghalaya, Himachal Pradesh & Bihar
4	April	2	32	15	1204	3	6	TN, Maharashtra, Karnataka & Uttar Pradesh
5	May	1	52	4	272	4	29	TN, Maharashtra & Karnataka
6	June	-	-	3	160	3	13	TN, Andhra Pradesh, Karnataka & Kerala
7	July	2	91	6	460	5	13	TN, Maharashtra & Kerala
8	August	2	73	5	612	6	9	TN, Maharashtra & Puducherry
9	September	2	82	13	758	6	9	TN, Andhra Pradesh, Karnataka & Maharashtra
10	October	-	-	12	827	3	6	TN & Maharashtra
11	November	3	107	7	281	1	6	TN, Kerala & Karnataka
12	December	2	84	12	865	1	1	TN, Maharasthra, Kerala & Uttar Pradesh
	TOTAL	**21**	**733**	**121**	**8932**	**53**	**134**	

During 2024, the section had organized 21 one-day training programmes with 733 trainees , 123 exposure visits benefitting 8932 students/academicians and 53 personalized advisories benefitting 134 sugarcane farmers.

d. Frontline Demonstrations in Farmers' Fields

- During the period two Frontline demonstrations (FLD) were conducted on the newly released varieties vz., Co 11015 and Co 14012 in farmers' fields. Each demonstration was conducted in a one-hectare plot following the recommended package of practices. Incentives were given to participating farmers.

- The FLD on Co 11015 was conducted in the field of Shri. D.Gnanasekaran, S/o. Shri Dhanavel (a registered cane grower of Rajshree Sugars; DoP: 21.01.2024), Rajanthangal village, Kilpennathur Taluk, Tiruvannamalai Dt.

Frontline Demonstration Plot of Co 11015

- The FLD on Co 14012 was conducted in the field of Shri. T.Thirukumaran. S/o. Shri Thangavel, Mathur village, Anthiyur Taluk, Erode district (a registered cane grower of Sakthi Sugars Ltd.; DoP: 11.01.2024).

Frontline Demonstration Plot of Co 14012

e. Field days conducted

- *Field day* of Co 11015

A Field Day was organized on 28 June 2024 in Rajanthangal village, Kilpennathur Taluk, Tiruvannamalai Dt. During this event, farmers in the vicinity and extension personnel were invited to witness the Frontline Demonstration field of the short-duration variety Co 11015, belonging to Shri. D.Gnanasekaran, S/o. Shri Dhanavel (a registered cane grower of Rajshree Sugars.

Co 11015 Field day in Tiruvannamalai District

- *Field day* of Co 14012

A 'Field Day' of the newly released sugarcane variety, 'Co 14012' was organized by ICAR- Sugarcane Breeding Institute (ICAR-SBI), Coimbatore in association with Sakthi Sugars Ltd. Appakudal in Mathur village, Anthiyur, Erode on 17.12.2024. During the event, the farmers were taken around the Frontline Demonstration (FLD) plot of the variety Co 14012 , being grown in the field of Shri. T.Thirukumaran. Dr. P. Govindaraj , Director , scientists from ICAR-SBI , senior officials from Sakthi Sugars Ltd, staff from Kumaraguru Institute of Agriculture and over 80 farmers had participated in the event.

Co 11015 Field day in Erode District

f. Visit to 'Cane-ovator' award-winning farmer's field:

ICAR-SBI team visited the field of Shri Anthonysamy, S/o. Shri Viyagappa nadar, an organic sugarcane farmer & *Cane-ovator* awardee in Puliangudi, Vasudevanallur block of Tenkasi district, Tamil Nadu, whose field with Co 86032 variety had yielded about 200 tonnes /ha in its 30th ratoon, on 14 June 2024.

Visit to a Cane-ovator awardee's organic sugarcane field

g. Technology Park:

Technology Park 2024 was planted in January 2024 with 17 sugarcane varieties (Co 86032, Co 11015, Co 99004, Co 92005, Co 06022, Co 13013, Co 06030, Co 14012, Co 0212, Co 12009, Co 18009, Co 10026, Co 0232, Co

0233, Co 05011, Co 00238, Co 09004) & tissue culture plants in 90 rows and maintained.

- *Frontline demonstrations*: Planted frontline demonstration in Marayoor on organic cultivation using bud chip settlings with planting material given from Technology Park.

h. Interaction with Krishi Vigyan Kendras:

- ICAR-SBI participated in the KVK Golden Jubilee Torch relay ceremony at Vadapudur village of Kinathudadavu block in Coimbatore district on 4.10.2024 and interacted with the farmers on scientific sugarcane farming.
- Participated in the SAC of Dharmapuri KVK and offered suggestions for implementation of programmes.
- Participated in the Scientific Advisory Committee of ICAR-KVK (MYRADA), Erode district and offered suggestions related to improving the income of sugarcane farmers in the district on 29.11.24.

i. Participation in exhibitions:

1. ICAR - SBI participated in Agri-Intex 2024 (International Agricultural Exhibition) by way of putting up a stall at CODISSIA Trade Fair Complex in Coimbatore during 11-15 July 2024.

ICAR-SBI Stall at Agri-Intex 2024

2. ICAR-SBI participated in the 'State-level Mega Farmers' Day-2024' organized by Tamil Nadu Agricultural University during 26-29 September 2024 and received the **'Best Stall Award'** during the valedictory function held on 29 September 2024.

'Best Stall' award for ICAR-SBI at TNAU State level Mega Farmers' Day

j. National Science Day:

ICAR – Sugarcane Breeding Institute celebrated the 'National Science day' as an 'open- day' under the theme "Indigenous Technologies for Viksit Bharat" on 28 February 2024. The students/teachers of schools and colleges in and around Coimbatore visited seven locations in the Institute campus *viz*., Institute museum, Science Exhibition at Centralized Bio-technology lab & Tissue culture lab, sugarcane -based farming system unit, Agri-business incubator that displayed and demonstrated Institute-developed products, auditorium that screened video films and the sugarcane juice counter, by scanning the location QR-codes displayed in the premises. Dr N Vijayan Nair, Former Director of ICAR-SBI delivered the National Science Day lecture on 'On the grass trail..'

School students lining up to visit Science Exhibition at National Science Day -2024

k. Publications: Compiled, edited and printed

- ICAR-SBI Annual Report 2023 (English)
- ICAR-SBI News-January 2023, April 2023 , September 2023 (45-3) and December (45-4)

l. Media efforts:

- ***Farm School on AIR:*** ICAR-SBI has launched a 'Farm School on AIR (FSA)' on '*Sugarcane farming for prosperity*' (வளமான வாழ்விற்கு கரும்பு சாகுபடி) in Tamil for the benefit of the farmers to gain the latest technical knowledge and information on scientific sugarcane cultivation in collaboration with Akashwani, Coimbatore. Altogether, 119 interested farmers have been enrolled in this Farm School. The school had 13 classes in all, and the first Introductory class was broadcast on 24.7.24. The details are given hereunder.

Farm School on All India Radio

S. No.	Session	Date of Broadcast
1	*Sugarcane Production – an overview'* by Dr.G.Hemaprabha (Interview mode)	24.7.24
2	*Promising Varieties for Tamil Nadu* by Dr P.Govindaraj	31.7.24
3	*Micropropagation in sugarcane* by Dr. D.Neelamathi	07.08.24
4	*Quality seed production in Sugarcane* by Dr. A.Annadurai	21.08.24
5	*Cane agronomy* by Dr.K.Kannan	28.08.24
6	*Irrigation and ratoon management in sugarcane* by Dr.P.Geetha	04.09.24
7	*Nutrient Management in sugarcane* by Dr.C.Palaniswami	11.09.24
8	*Mechanization in sugarcane* by Dr T. Arumuganathan	18.09.24
9	*Value added products from Sugarcane* by Dr. K. Hari	25.09.24
10	*Integrated Disease management in sugarcane* by Dr. A. Ramesh Sundar (Interview mode)	02.10.24
11	*Integrated Pest Management in Sugarcane* by Dr. B. Singaravelu	09.10.24
12	*Sources of Sugarcane Information* by Dr. D. Puthira Prathap	16.10.24
13	*Entrepreneurship development in sugarcane* by Dr. P. Murali	23.10.24

Farm School on 'Sugarcane Farming for Prosperity'

- A radio feature on Impact evaluation of DAPSTC implementation in Bathripadugai tribal hamlet of Sathyamangalam Tiger Reserve was broadcast through All India Radio, Coimbatore on 11.01.2024 (FM 103 and MW 300.3)
- A radio feature on 'Tribal Nutrition Awareness cum Training Campaign'' organized by ICAR-Sugarcane Breeding Institute and launch of DAPSTC (Development Action Plan for Scheduled Tribe Component) project in Salem district, Tamil Nadu' was broadcast through All India Radio , Dharmapuri on 13.03.2024 and streamed live on Newsonair app at 2.00 pm in its '*Vivasaaya arangam*' programme.
- A radio feature on the 'Impact evaluation' of DAPSTC project in STR was broadcast through All India Radio , Coimbatore in its '*Oorpurathile*' programme on 16.6.2024.
- A video -feature on Soil Moisture Indicator and Digital Soil Moisture Indicator was published in News18 news channel (https://tamil.news18.com/technology/coimbatore-sugarcane-breeding-institute-discover-soil-moisture-indicator-for-water-saving-rkj-mkn-local18-1586209.html)
- An interview with Dr D.Puthira Prathap, Head, Extension section on the extension initiatives was broadcast through All India Radio (Akashvani),

Coimbatore on 9.10.2024 in its *Oorpurathile* programme.

- A feature on conduct of Field day on Co 14012 at Mathur village of Erode district was broadcast through All India Radio, Coimbatore on 21.12.2024 (Part-1) and 22.12.2024 (Part-2)
- A video feature on Energy canes was published in News18 News channel (https://www.news18.com/india/this-institute-in-coimbatore-breeds-a-special-variety-of-sugarcane-for-ethanol-production-9078220.html)
- Use of social media for transfer of technology: ICAR-SBI has been regularly reaching out to the stakeholders of sugarcane agriculture through social media such as Facebook (https://www.facebook.com/icar.sbi) , YouTube (http://www.youtube.com/@icar-sugarcanebreedinginst1942 ; http://www.youtube.com/caneinfo) X (@ BreedingIcar).

Video feature on 'Energy Canes'

(D. Puthira Prathap and T. Rajula Shanthy)

Evaluating the effectiveness of state-level sugarcane R & D workshops – A cross-state assessment

The State - level Sugarcane R&D workshops (Formerly called as Sugarcane R&D workers' meetings) is a unique outreach initiative of ICAR-Sugarcane Breeding Institute having a history of over three decades. Providing an interface between the researchers and the development personnel, these R&D workshops ensure the timely and effective transfer of the latest technologies developed at the research stations to the sugarcane growers. This project was formulated to evaluate these state-level Sugarcane R&D workshops, to know the extent to which the outcomes implied from the workshop objectives have been realized. This would also help in generating data for the benefit of the sponsors of the workshop (the sugar factories or research institutions, as the case may be), to improve the conduct of future workshops and to show their potential to the future participants as well as the policy makers *viz*., the respective state governments. The locations of study are Tamil Nadu/Puducherry, Southern Karnataka and Northern Karnataka.

During the period under report, a survey was taken up in Southern Karnataka. The questionnaires were administered to the participants of the recently concluded 22nd Sugarcane R&D workshop of Southern Karnataka during 20-21 June 2024. Altogether 82 persons had responded to the survey. Among the 82 respondents, 1.2 % belonged to Public sector factories, 97.5 % belonged to Private sugar factories while 1.2 % belonged to research/educational institutions.

The observations of the study were

- 'Opportunity to meet colleagues/Networking' and 'Opportunity to interact with scientists/experts' were the major factors that influence the decision of the respondents to attend R&D workshop
- Varieties/Sugarcane improvement and Crop protection were the major topics the respondents were most interested in the workshops
- Respondents had rated the 'accuracy' and 'understandability' of the pre-R&D workshop correspondence as 'higher' and' Appropriateness of level of detail' and 'Ability to hold interest' as 'moderate'.
- As for the organizational aspects of R&D Workshops, the respondents were 'very satisfied' with 'Expertise of resource persons' ,'Opportunity to express opinions during the workshop' and 'Clarity of correspondence'
- Sugarcane R&D workshops had made an impact on Cane management aspects such as 'Variety utilization pattern", Environment -friendly practices' and 'Micro-irrigation techniques'.

Filling-out of questionnaires by respondents at the 22nd Sugarcane R&D workshop of Southern Karnataka

(D. Puthira Prathap and P.Murali)

Social impact assessment of micropropagation in sugarcane: An explanatory analysis

Social impact assessment was undertaken to study the spread and acceptance of micropropagation technology in sugarcane, analyze the perception of cane growers and cane personnel about micropropagation, analyze the constraints faced by stakeholders in adopting micro-6propagated plants and study the advantages realized in adopting micro-propagated plants.

A questionnaire was developed & pretested with non-sample respondents for the study. Survey with 41 cane staff of private and cooperative sugar mills revealed that the main source of procuring micro-propagated plants were Sugarcane Breeding Institute & Growmore Biotech. The plants are then multiplied in the R&D farm of sugar mills or supplied to farmers through the sugar mills; Innovative farmers also get the plants directly from the available sources. They consider micro-propagated plants to be the best choice of planting material, be it for use as setts for planting after growing it for 6-8 months or for use as bud chips for settling production.

Perceived advantages of using micro-propagated plants were production of quality planting material, maintenance of genetic purity, high yield, fast multiplication of new varieties, possibility of getting more setts/settlings, good quality cane thereby high recovery. Constraints faced were difficulty in convincing farmers, lack of innovative farmers to take up micro propagated plants, non-availability when there is high requirement, less awareness among cane growers, need trained manpower for producing plants in sugar mills.

Discussions held with farmers who had procured micro-propagated plants from the Institute and have raised sugarcane settling nurseries revealed that choice of varieties of plants are Co 86032 and any other new variety released from the Institute.

Few case studies on farmers who had successfully taken up sugarcane settling nurseries by using micro-propagated plants procured from the Institute were recorded. They have taken up sugarcane settling nursery units using the bud chips of micro-propagated plants grown for 6-8 months and is a successful venture. Survey with growers invariably indicated that use of micro-propagated plants gave good tillering, uniform crop growth, good crop stand, initial high vigour leading to better yield. However, they felt that cost is high, more suited for wide-row cultivation, non-availability of plants of desired varieties, needs more care and establishing in summer is difficult.

(T. Rajula Shanthy, C. Jayabose and D. Neelamathi)

Development of Cane Adviser, a mobile application for transfer of sugarcane technologies

Work was initiated to develop the version 2.0 of Cane Advisor mobile app; the specific objectives being to develop an interactive mobile based application software (app) on sugarcane, to create a database and establish a network of sugarcane stakeholders, to study the usage pattern and impact of the 'Cane Adviser' app at different stakeholders level.

To start with, the requirement of the sugarcane growers / cane staff was analyzed through focus group discussions in the villages and during other interface meetings; the information were collected in terms of pattern of mobile use, content needs in the app, services required through

the app, format of the messages, preferred medium of communication *etc.* and accordingly a blueprint for the app and storyboard was developed. The revised content with text and images is being developed.

(T. Rajula Shanthy, G. Hemaprabha, S. Alarmelu, K.P. Salin, C. Jayabose, P. Malathi, A. Vennila and S. Anusha)

ICAR-SBI Development Action Plan for Scheduled Tribe Component (DAPSTC)

This project was implemented in Sathyamangalam Tiger Reserve (STR) of Erode district and in Eastern Ghats (Chinna Kalrayan hills) of Salem district, Tamil Nadu.

1. **Request/Appreciation from Tamil Nadu State Rural Livelihood Mission, Salem:** Appreciating the work of the Institute under DAPSTC project in Anamalai Tiger Reserve and Sathyamangalam Tiger reserve, the Tamil Nadu State Rural Livelihood Mission, Salem had invited ICAR-SBI to implement the project in Salem district since the district has the highest tribal population in the state with 373 tribal villages and a tribal population of 1.67 lakh. Subsequently, based on the personal interactions with the tribals and officials , Salem district was selected.
2. **Conduct of needs assessment, identification of gaps and organizing a series of campaigns in the tribal settlements**

In consultation with the officials and officials of other line departments, an interview schedule was prepared for needs assessment, identification of gaps and possible interventions, to conduct baseline surveys. Focus groups were initially conducted in the tribal settlements of Salem district.

The fact that the tribals of Molayanoor and Vilampattu grow sugarcane, was also considered for selection of villages. The details are given hereunder.

Selected Tribal Settlements in Chinnakalrayan hills – Vadakkunadu panchayat	Selected Tribal Settlements in Aladipatti Panchayat, Ayodhyapattinam
Pallikkadu	Molayanoor
Thaloor	Vilampatti
Valoothu	

Project implementation area- Salem district

3. Launch of STC in Salem district and distribution of items/inputs

A formal 'launch programme of STC / *'Tribal Nutrition Awareness cum Training Campaign'* was organized in the collectorate premises of Salem district, on 12 March 2024.The Director of ICAR-Sugarcane Breeding Institute and Dr R Brindha Devi IAS., Collector, Salem district interacted with the tribals during the occasion.

Launch of STC project by District Collector, Salem

4. Training the Tribal Sugarcane farmers:

Two tribal settlements *viz*., Molayanoor and Vilampattu have tribal farmers who had been growing sugarcane for a long time. A '***Training Campaign for Tribal Sugarcane Farmers'*** as part of project was organized at Karumanthurai, Chinna kalrayan hills, Salem district 27 June 2024 for the tribal sugarcane farmers of Molayanoor and Vilampattu. The Director of ICAR-Sugarcane Breeding Institute, Managing Director of Subramaniya Siva Co-op Sugars, officials from TNSRLM and several tribals participated in the programme. A publication entitled தமிழ்நாட்டுக்கு உகந்த கரும்பு இரகங்கள் (Sugarcane varieties suitable for Tamil Nadu) was published as part of DAPSTC project.

'Training Campaigns for Tribal Sugarcane Farmers'

5. Tribal awareness cum training campaigns

- As part of the project, 'Tribal Nutrition Awareness cum Training' Campaigns were conducted in Ittarai and Thadasalatti villages. During these campaigns, sessions for knowledge empowerment were handled by experts and farm tools, household items, seed kits for setting up nutrition garden, radio sets, areca nut seedlings, vermicompost, liquid jaggery *etc*., were distributed among all the tribal households. All tribals who participated in these campaigns were administered the *'Pledge against malnutrition'*. Extension literature on setting up of nutrition gardens, millet cultivation, leaflet on All India Radio programmes, Fall Army Worm Management, Arecanut cultivation and Millet recipes were prepared and distributed. Pulverizers along with logbooks were handed over to the tribal hamlets.
- Empowerment of indigenous communities through millet-entrepreneurship was highlighted during the conduct of 'Tribal awareness cum campaign' among the tribals in Pallikkadu tribal settlement in Aladipatti panchayat of Salem district on 29 August 2024. The campaign was conducted as part of STC project being implemented by the Institute, in collaboration with Tamil Nadu State Rural Livelihood Mission (TNSRLM), Salem. Scientists from ICAR-SBI, ICAR-CIAE, TANUVAS and TNAU handled the training sessions.

Training cum awareness campaign for promoting millet entrepreneurship at Pallikkadu tribal settlement

- The significance of growing vegetables and millets and including them in the daily diet of indigenous communities was highlighted during the conduct of'Tribal awareness cum campaign' among the tribals in Thaloor and Valoothu tribal settlements in Aladipatti panchayat of Salem district on *13 August 2024*. Scientists from ICAR-SBI, ICAR-CSWRI and TNAU handled the training sessions.

6. Impact of DAPSTC Project

- Impact evaluation of 'DAPSTC' project was conducted at Galithimbam, Mavanatham, Bejalatti and Ramanai tribal hamlets of Sathyamangalam Tiger Reserve on 30 May 2024. A radio feature on this 'Impact evaluation' was broadcast through All India Radio , Coimbatore in its '*Oorpurathile*' programme on *16.6.2024*.

Impact evaluation of DAPSTC project at Galithimbam tribal settlement

- Impact evaluation of 'DAPSTC' project and an awareness campaign was conducted at Nagaroothu-1 tribal hamlet of Anamalai Tiger Reserve on 20.09.2024.
- A feature on the impact of DAPSTC project was published by Dinamalar, a popular Tamil daily on 23.9.2024 (https://www.dinamalar.com/news/premium-news/mountain-residence-without-electricity--pudupolivu-now-by-central-government-scheme-/3739671)
- An impact evaluation of DAPSTC was carried out by ICAR through *Global AgriSystem pvt. ltd* during August 2024.

வனப்பகுதியில் வாழ்க்கை நடத்தும் மலசார் பழங்குடி மக்கள்... தேடிச்செல்லும் அடிப்படை வசதிகள்...

Reported by: Ruban Santha Kumar J news18-tamil
Published by: Muthu Kathan
Last Updated: October 08, 2024 11:25 AM IST

இங்கே வசிக்கும் மக்களுக்கு ஏதாவது ஒரு பிரச்சனை என்றால் இங்கிருந்து கீழே இறங்கி சேத்துமடைக்கோ, பொள்ளாச்சிக்கோ போய் தான் வைத்தியம் பார்க்க வேண்டியுள்ளது.

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கோவையில் செயல்பட்டு வரும் கரும்பு இனப்பெருக்க நிறுவனத்தினர், பழங்குடியினர் மேம்பாட்டுத் திட்டத்தின் மூலம் ஒரு ஆறு பழங்குடியின மக்களைத் தத்தெடுத்து, அவர்களுக்குத் தேவையான உதவிகளை வழங்கியுள்ளனர்.

வாகனங்கள் கூட செல்ல முடியாத அந்த இடத்தில் அவர்களுக்குத் தேவையான மருத்துவத் தேவையையும், உணவுத் தேவையையும் அவர்களே அடைய வேண்டுமென்று இத்தகைய உதவிகளைக் கரும்பு

A feature on DAPSTC project was published in News 18 TV channel

- A video feature on STC 'Impact evaluation' was published in Dinamalar YouTube channel (https://www.youtube.com/watch?v=mmEtodjI_mo)
- A video feature on DAPSTC project was published in News18 news channel (https://tamil.news18.com/coimbatore/sugarcane-breeding-institute-providing-basic-needs-to-malasar-tribe-people-living-in-forest-rkj-mkn-local18-1619382.html)

Dinamalar daily; September 23, 2024

மின்சாரமே பார்க்காத மலைவாழ் குடியிருப்பு!

மத்திய அரசின் திட்டத்தால் இப்போது புதுப்பொலிவு

'வேலைக்கு போக முடிகிறது'

'சார்மாருக்க சென்ன பிறகு 21 வயகலதான் கல்யாணம்'

'தினமும் ரேபோவில் செய்தி கேட்கிறோம்'

Impact of DAPSTC project that appeared in Dinamalar Tamil daily, 23.9.24

(D. Puthira Prathap, K. Mohanraj, R. Gopi, P. Geetha and V. Sreenivasa)

5.6. ICAR-Sugarcane Breeding Institute, Regional Centre, Karnal

Breeding superior sugarcane varieties of different maturity with improved cane yield, quality and resistance to biotic and abiotic stresses

Breeding elite clones suitable for NWZ

Sugarcane variety notified for commercial cultivation

Co 17018 (Karan 17), a midlate maturing high-yielding sugarcane variety derived from Co 0327 GC and developed at the ICAR-Sugarcane Breeding Institute, Regional Centre, Karnal (Haryana). Due to superior performance in AICRP (S) trials, it was identified by the VIC of AICRP (S), in the group meet held during 26-27, Oct 2023 at RAU, Pusa, Bihar. Its release proposal was approved by 92nd meeting of CVRC commenced on August 2, 2024. It was one among the 109 climatic resilient varieties dedicated to the nation by Honorable Prime Minister Shri Narendra Modi on 10.08.2024. The variety was gazette notified (SO 4388 (E) dated 08.10.2024) for commercial cultivation in NWZ comprising the states of Delhi, Haryana, Punjab, Rajasthan, Uttrakhand and Uttar Pradesh (Central and Western parts).

Comparative performance of Co 17018 in AICRP trials for cane yield and juice quality with the standard varieties

Item	Co 17018	CoS 767	CoPant 97222	Co 05011
Cane yield (t ha^{-1})	91.48	81.31	80.81	84.64
Increase or decrease over checks (%)		(+) 13.07	(+) 14.18	(+) 8.52
Sugar yield (t ha^{-1})	11.77	9.91	10.07	10.77
Increase or decrease over checks (%)		(+) 19.10	(+) 18.19	(+) 9.76
Sucrose %	18.38	17.48	17.99	18.12
Increase or decrease over checks (%)		(+) 5.12	(+) 2.25	(+) 1.46

(Ravinder Kumar, Mintu Ram Meena, R. Karuppaiyan, Bakshi Ram, Neeraj Kulshreshtha, G. Hemaprabha, M.L. Chhabra, S.K. Pandey, Pooja and B. Parameswari)

Supply of AICRP accepted 23 series Co canes for multiplication: Three early (Co 23022, Co 23025 and Co 23026) and two midlate (Co 23023 and Co 23024) genotypes accepted for inclusion in AICRP trials in the AICRP group meet held during 26-27, Oct 2023 at RAU, Pusa, Bihar, were supplied to the UPCSR Shahjahanpur, the seed multiplication centre during March 2024.

Co canes accepted for inclusion in AICRP trials: Six Co canes, three under early (Co 24016, Co 24017, Co 24018) and three under midlate (Co 24019, Co 24020, Co 24021) were accepted for inclusion in ZVT of NWZ in the AICRP workshop held at PAU, Ludhiana during 21-22, Oct 2024.

Hybridization, Progeny evaluation and selection (2023-24)

Seedling raising and field transplanting in-ground nursery: A total of 55 bi-parental cross combinations were effected at NHG, ECC, and Agali using the available male and female parents. Fluff from 60 bi-parental, 11 PC, and 12 GC was raised in the mist chamber during April 2024. The germination and survivability of seedlings were observed to be good, with varying levels of intensity. By July 2024, a total of 8646 seedlings were successfully transplanted into the field. These seedlings will be ratooned during the peak winter season on 14th January 2025 to harvest their ratooning potential.

(M.R Meena and Ravinder Kumar)

Seedling selection in the ground nursery 2023-24: A total of 613 better-performing progeny representing 121 cross combinations, were selected from the 8139 seedlings in ground nursery based on HR Brix, NMC, cane diameter, cane height and other desirable morphological traits. After assigning selection number K22-01 to K22-613, they were transplanted under the C1 evaluation stage in the augmented design along with four standards (Co 0238, CoJ 64, Co 05011 and CoS 767).

(Ravinder Kumar and M.R. Meena)

First clonal trial (C1):

The 375, K20 series selections (K20-001 to K20-375), were evaluated for periodic growth, yield and quality traits. Based on their field performance and red rot reaction, 128 better performers were selected and advanced to next stage of evaluation i.e. Preliminary trial (C2 stage), and planted in RBD.

Red rot: Among the 375 clones of C1 trial evaluated against CF13 isolate of red rot, 82 were found to be resistant, 121 moderately resistant, 38 moderately susceptible, 43 susceptible and 91 highly susceptible.

(Ravinder Kumar, M.R. Meena and M.L. Chhabra)

Preliminary trial 2023-24

The experiment consisting 80 test clones and four standards was evaluated for agronomical and quality parameters. Co 05011 (106.9) was the best standard for NMC (000/ha), and 11 test clones were at par with it. At 8th month of crop stage for juice sucrose%, 10 test entries K19-234 (18.97), K19-172 (18.88), K19-175 (18.86), K19-152 (18.74), K19-39 (18.7), K19-47 (18.67), K19-240 (18.61), K19-91 (18.57) and K19- 23 (18.55) were found promising over best standard CoJ 64 (18.49%). Whereas, 20 entries were promising over Co 0238 (17.81%). At the 10th month, Co 0238 (18.61%) was the best among standards and entries K19-82, K19-134, K19-152, and K19-157 recorded >19.7% sucrose in juice, whereas 43 clones were at par with it. The mean cane yield of the trial was 78.50 t ha^{-1} and Co 0238 (90 t ha^{-1}) was the best standard. Seven entries namely K19-197, K19-79, K19-84, K19-175, K19-159, K19-110, and K19-106 were superior to Co 0238 for cane yield at 10th month. A total of 43 promising clones of the K19 series were selected from the preliminary trial based on the red rot rating, desired morphological traits, cane yield, and quality parameters and advanced to the PZVT evaluation for 2024-25.

Red rot: Among the 85 preliminary clones evaluated, 38 were resistant, 32 were moderately resistant, six were moderately susceptible, four were susceptible and five were highly susceptible to CF08 isolate. Similarly, against the CF13 isolate, 11 clones were found resistant, 30 moderately resistant, four moderately susceptible, 16 susceptible, and 24 highly susceptible to red rot.

(M.R. Meena, Ravinder Kumar and M.L. Chhabra)

PZVT trial (2023-24)

A total of 39 test entries along with four standards *viz*., CoJ 64, Co 0238, CoS 767 and Co 05011 were evaluated in the PZVT trials for various cane yield and juice quality parameters. Test clones K15-011 (1,30,560) and WL13-815 (1,26,540) produced significantly higher millable canes than best standard Co 05011 (1,06,790). The periodic juice analysis performed at 8th, 10th and 12th month of crop stage revealed that for sucrose% at 8th month crop, clones K15-013 (18.98%), K17-111 (18.93%), K15-342 (18.90%), K15-370 (18.85%), WL13-456 (18.85%), and K18-34 (18.66%) were comparable with the best standard, CoJ 64 (18.55%). At 10th month, clones K15-013 (19.54%), K15-370 (19.39%), K18-47 (19.37%), K13-442 (19.35%), and K15-342 (19.26%) had comparable sucrose% with best standard Co 0238 (19.15%), whereas at 12th month, eight clones namely K18-44 (21.11%), K15-013 (20.96%), K15-292 (20.95%), K18-81 (20.94%), K15-420 (20.65%), K15-342 (20.56%), K18-47 (20.55%) and K15-370 (20.47%) accumulated higher juice sucrose than Co 0238 (19.79%). The single cane weight (kg) of eight test clones namely K15-582 (1.76), K15-528 (1.72), K18-44 (1.65), K 18.47 (1.64), K18-88 (1.63), K18-81 (1.62), WL08-338 (1.51), and K15-002 (1.50) was superior than best standard Co 0238 (1.28). Co 0238 (130.87 t ha^{-1}) was the best standard for cane yield (t ha^{-1}) and 13 test clones namely K15-582 (164.77), K15-528 (164.19), K18-88 (160.02), WL08-338 (158.90), K15-002 (158.43), K15-011 (158.30), K18-47 (155.45), K15-013 (151.91), K15-008 (151.05), WL13-815 (149.74), WL-456(146.30), K18-36 (147.89) and K15-343 (144.39) performed better.

Considering periodic juice quality trend, cane yield and its contributing traits, field stand and red rot reaction, three clones namely K 15-013 (Co 24016), K15-342 (Co 24017) & K18-47 (Co 24018) under early; and three clones namely K05-011(Co 24019), K15-560 (Co 24020) & K18-81(Co 24021) under midlate were identified for the status of Co canes.

Red rot: Thirty-nine PZVT clones were evaluated and 25 were found to be resistant, 8 moderately resistant, three moderately susceptible and three susceptible with CF08 isolate, while with CF13 isolate, 12 clones were resistant, 11 moderately resistant, two moderately susceptible, four susceptible and 10 highly susceptible reactions to red rot. During current season, 47 PZVT clones have been inoculated for red rot evolution.

(Ravinder Kumar, M.R. Meena and M.L. Chhabra)

Hybridization (2024-25)

A total of 85 cross combinations (including 62 biparental cross and 23 GC/PCs) were attempted during the flowering season 2024 (November-December) choosing trait-specific, diverse genetic makeup, proven and newly developed "Co" canes or genetic stock as parents. The fluff after harvest will get dispatched to Karnal centre in February 2025.

(Ravinder Kumar, M.R. Meena, R.M. Shanthi and A. Anna Durai)

Progeny evaluation and Selection (2024-25)

First clonal trial (C1) 2024-25: A total of 640 clones of the K21 series were evaluated for cane quality at the 8th month crop stage. Co 15023 was the best standard with 21.0 HR brix%. A total of 45 entries had >21% HR Brix and nine entries had more than >22% HR Brix%, out of which, seven clones *viz*., K21-182, K21-183, K21-193, K21-312, K21-495, K21-552, and K21-606 were found R or MR against CF13 pathotype of red rot.

Red rot: Among the 640 clones of C1 trial evaluated against CF13 red rot isolate; 35 were found to be resistant, 195 moderately resistant, 94 moderately susceptible, 147 susceptible, and 206 highly susceptible.

(M.R. Meena, Ravinder Kumar and M.L. Chhabra)

Preliminary trial (2024-25): A total of 128 test entries of K20 series along with four standards were evaluated for cane yield, juice quality and other desirable morphological traits. CoJ 64 with 16.7% juice sucrose at 8th month was the best standard and eleven test entries *viz*., K20-05 (18.48), K20-228 (18.16), K20-366 (17.48), K20-369 (17.46), K20-012 (17.43), K20-029 (17.40), K20-06 (17.33), K20-051 (17.30), K20-270 (17.27), K20-026 (17.14), and K20-160 (17.09) found to be superior and 14 genotypes were found to be on par performance with CoJ 64.

Red rot: A total of 128 early generation clones were evaluated for red rot reaction against CF08 & CF13 isolates of the disease. Against CF08 isolate, 18 were found to be resistant, 90 moderately resistant, 9 moderately susceptible, and 11 susceptible, whereas against CF13 isolate 21 genotypes were resistant, 84 moderately resistant, 13 moderately susceptible, 9 susceptible, and 1 highly susceptible.

(Ravinder Kumar, M.R. Meena and M.L. Chhabra)

PZVT trial (2024-25):

A total of 47 test entries of the K19 series along with four standards were evaluated for cane yield, juice quality, and other desired morphological traits. Among the standards, Co 05011 (1.05 lakh/ha) was the best for NMC at 240 days and eight entries recorded superior values. CoJ 64 with 16.8% juice sucrose at the 8th month crop stage was the best standard and eight test clones *viz*., K19-08 (18.10%), K19-010 (17.73%), K19-175 (17.85%), K19-172 (17.28%), K19-12 (17.14%), K19-72 (16.96%), K19-134 (16.91%), and K19-161(16.81%) were found to have numerically higher value for juice sucrose %, whereas other 25 test clones were on par with the best standard.

Red rot: A total of 43 clones were inoculated by CF08 & CF13 isolates to evaluate theirresistance to red rot. Against CF08 isolate, 15 were found to be resistant, 20 moderately resistant, and 1 moderately susceptible, whereas against CF13 isolate 1 genotype was found to be resistant, 28 were moderately resistant, 6 were moderately susceptible, 6 were susceptible, and 5 were highly susceptible.

(M.R. Meena, Ravinder Kumar and M.L. Chhabra)

Performance of Early maturing clones in PZVT at ICAR-SBIRC, Karnal during crop season 2023-24

Genotype	CCS t ha^{-1} 10M	Cane Yield t ha^{-1}	Sucrose %			Brix %			NMC 000/ ha	Cane length (cm)	Cane Dia (mm)	SCW (kg)
			8M	10M	12M	8M	10M	12M				
Co 24016 (Co 0238 x Co 1148)	20.88*	151.91*	18.38	19.37	20.55	19.41	21.24	22.18	102.16	270*	2.81	1.49

Genotype	CCS t ha^{-1} 10M	Cane Yield t ha^{-1}	Sucrose %			Brix %			NMC 000/ ha	Cane length (cm)	Cane Dia (mm)	SCW (kg)
			8M	10M	12M	8M	10M	12M				
Co 24017 (CoH 99 x Co 94008)	19.48*	144.39*	18.98	19.54	20.96	20.71	21.36	22.38	116.05	227	2.67	1.25
Co 24018 (Co 11015 x Co 8347)	21.12*	155.45*	18.90	19.26	20.56	20.41	21.17	22.00	94.75	277*	2.96*	1.64*
Standards												
CoJ 64	13.11	100.98	18.55	18.52	19.09	20.16	20.40	20.65	100.93	233	2.26	1.01
Co 0238	17.34	130.87	18.20	19.15	19.79	20.36	21.63	21.87	102.16	247	2.60	1.28
CD	1.54	10.96	0.86	0.78	0.65	0.83	0.8	0.62	14.44	27.66	0.32	0.22
CV	5.82	8.15	3.17	2.67	2.04	2.72	2.47	1.79	8.71	6.88	7.87	10.43

Performance of Midlate maturing clones in PZVT at ICAR-SBIRC, Karnal during crop season 2023-24

Genotype	CCS t ha^{-1} 12M	Cane Yield t ha^{-1}	Sucrose %			Brix %			NMC 000/ ha	Cane length (cm)	Cane Dia (mm)	SCW (kg)
			8M	10M	12M	8M	10M	12M				
Co 24019 (Co 97015 x Co 775)	22.44*	158.30*	16.29	18.25*	20.03*	18.66	20.63	21.60	130.56	260*	2.53	1.22*
Co 24020 (Co 97015 x Co 775)	18.66*	135.74*	16.81	18.61*	19.65*	19.08	20.72	21.68	94.44	233	3.00*	1.44*
Co 24021 (CoVc 14061 x Co 97015)	19.83*	134.71*	17.53	18.36*	20.94*	19.71	20.26	22.88	84.57	267*	2.62	1.62*
Standards												
CoS 767	13.82	106.14	16.89	17.44	18.52	18.95	19.28	20.22	103.70	232	2.20	1.03
Co 05011	16.71	122.76	16.20	17.25	18.84	18.45	19.41	20.73	106.79	218	2.53	1.19
CD	1.6	10.96	0.86	0.78	0.65	0.83	0.8	0.62	14.44	27.66	0.32	0.22
CV	5.45	8.15	3.17	2.67	2.04	2.72	2.47	1.79	8.71	6.88	7.87	10.43

Enhancement of sugarcane germplasm and development of pre-breeding material

Evaluation of sugarcane germplasm, ISH, and IGH Clones under sub-tropical conditions

ISH trial (Plant crop): A total of sixteen ISH entries along with the four standards were planted in drought and normal plots. Drought was imposed during formative stage of the crop by withholding irrigation. The mean tiller population under normal and drought was 0.76 and 0.71 lakh ha^{-1} respectively. Among the standards, Co 0238 performed better and had less reduction in plant height (22.40%). Eight test entries *viz*, TSGS 20-57-22

(2.26%), M 68-20 (4.44%), FWC 2-14 (9.43%), TSGS 14-102-13 (12.01%), TSGS 20-74-20 (11.59%), TSGS 20-73-26 (14.91%), TSGS 14-39-15 (14.64%), and TSGS 14-116-12 (19.36%) had less reduction for plant height under drought stress. At 8th month, Co 0238 was best among the standards with a 19.57% reduction under drought and seven test entries had less reduction for NMC than Co 0238. In the 8th month juice analysis, the mean single cane weight under normal and drought conditions was 0.79 kg and 0.64 kg respectively. Among standards, Co 0238 had less reduction (23.32%) under drought conditions and 10 test entries had lesser reduction than Co 0238. The overall cane height under normal and drought conditions was 177cm and 148 cm respectively. The mean estimated cane yield at 240 days under normal and drought conditions was 55.97 t ha^{-1} and 36.54 t ha^{-1} respectively with a mean reduction of 35.82% under drought conditions. Co 0238 had less reduction for cane yield (38.32%) under drought conditions and eight test entries had lesser reduction than Co 0238 for cane yield at the 8th month.

Ratoon trial: Co 05011 was the best among the standards with 15.48% reduction in NMC and seven test entries *viz*., 14-67 (5.2%), 14-114 (5.21%), 14-124 (7.8%), TWC 82-18 (12.2%), 14-58 (14.28%), 14.195 (13.4%), and 14.161 (13.6%) recorded on par reduction with Co 05011. Among the standards, Co 05011 was best with the least reduction (19%) for single cane weight in the 9th month, and six test entries had a lesser reduction for single weight than Co 05011. The mean cane yield in normal and drought conditions was 60.77 t ha^{-1} and 37.62 t ha^{-1} respectively with a mean reduction of 37% under drought stress. Co 0238 was the best standard with a 27% reduction in cane yield under drought conditions.

Screening of sugarcane germplasm under salinity stress: Based preliminary studies, five tolerant genotypes *viz*., SA 14-161, SA 14-90, SA 14-111, IND 1037 and IND 1041 along with standard Co 0238 were planted for evaluation at two levels of salinity stress at 6 and 8 dSm^{-1} were imposedat 45 days of planting (DAP) of. Under stress, a gradual decrease was recorded in all the studied parameters with progressive increase of salinity stress from 6 to 8 dSm^{-1}. Clones SA 14-161 and SA 14-90 and *Saccharum spontaneum* clones IND 1037 and IND 1041 showed less than average reduction, whereas maximum reduction was noticed in SA 14-111. Chlorophyll content reduced by 16.15% and 19.90% under 6 and 8 dSm^{-1} level, respectively as compared to normal irrigated control (41.2 µg cm^{-2}). Genotypes SA 14-161, SA 14-90, IND 1037 and IND 1041 maintained higher chlorophyll content than standard Co 0238. Under normal irrigation, photosynthetic rate, transpiration rate and stomatal conductance were 18.62 µmol CO_2 m^{-2} s^{-1}, 8.72 mmol H_2O m^{-2} s^{-1} and 0.492 mmol H_2O m^{-2} s^{-1} respectively and reduced by 33.12%, 25.16% and 26.09% under 8 dSm^{-1}. Na^+/K^+ in leaf increased from 0.125 (control) to 0.491 and 0.688 in 6 dSm^{-1} and 8 dSm^{-1}, respectively. ISH 14-161, ISH 14-90, IND 1037 and IND 1041 performed better than best standard Co 0238 under all the studied level of salinity stress. MDA content was also lower in these ISH clones than the standard check except SA 14-90, which showed higher accumulation of MDA (1.62 nmol g^{-1} FW).

Screening of sugarcane germplasm for drought tolerance under controlled conditions: Based on the previous year studies in field conditions, five tolerant clones *viz*,. SA 14-161, SA 14-90, SA 14-111, IND 1037 and IND 1041 with standard Co 0238 were planted in controlled condition under rainout shelter. Drought stress was imposed during formative phase which coincided with high temperature during summer months. Average plant height was 215 cm in control and reduced by 29% under drought. Likewise, tiller population reduced up to 23%. In control, photosynthetic rate, transpiration rate and stomatal conductance were 19.10 µmol CO_2 m^{-2} s^{-1}, 7.12 mmol H_2O m^{-2} s^{-1} and 0.412 mmol H_2O m^{-2} s^{-1}, respectively and reduced by 39.27%, 28.16% and 17.09%. Genotypes 14-161, 14-90, IND 1037 and IND 1041 were found to be tolerant under drought stress by maintaining less reduction in leaf area, gaseous exchange parameters and less canopy temperature under drought.

Red rot: Among the 16 ISH clones evaluated for red rot resistance, 9 clones were moderately resistant, 3 were moderately susceptible, and 4 were susceptible reactions to CF08 isolate, whereas 8 clones were moderately resistant, 2 moderately susceptible, 5 susceptible and one highly susceptible to CF13 isolate.

(M.R. Meena, Ravinder Kumar, M.L. Chhabra and Pooja)

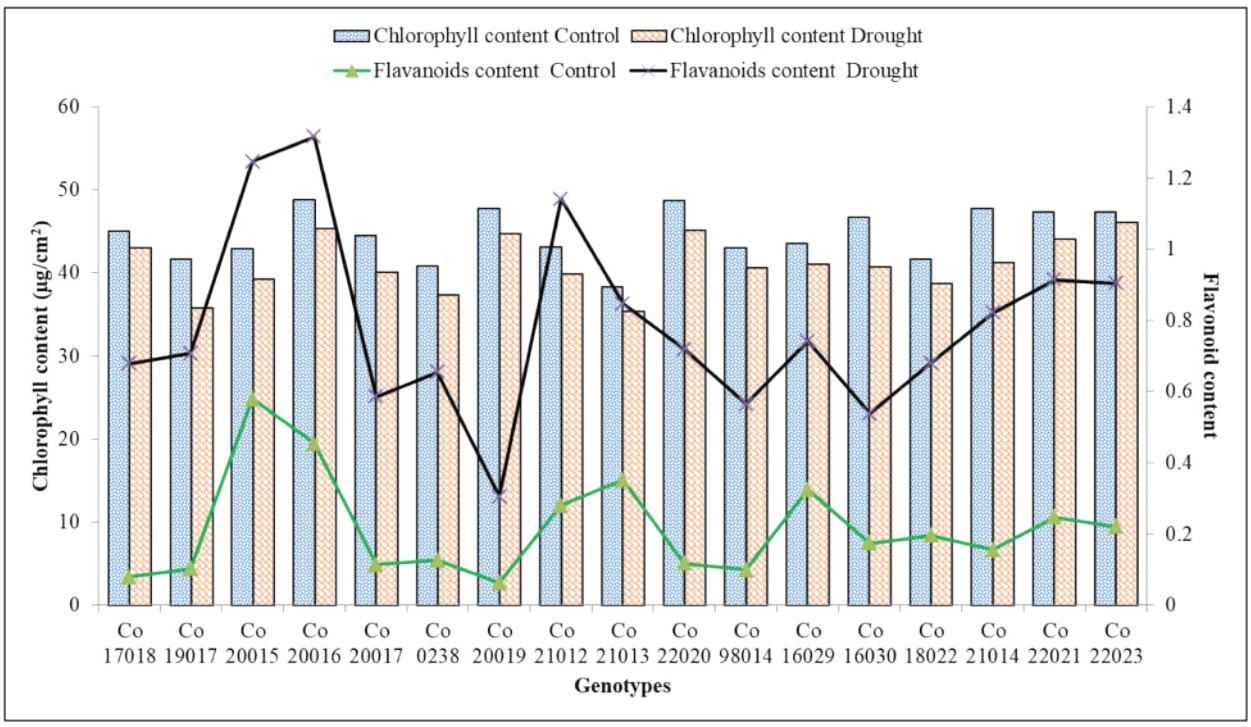
Deciphering the mechanism of drought tolerance in sugarcane through physiological traits and root characteristics under sub-tropical conditions

Evaluation of plant crop under drought stress: An experiment was conducted to study the effect of drought stress in 15 sugarcane genotypes with two standards *viz*. Co 0238 and Co 98014. Drought stress was imposed during formative phase of the crop by withholding

irrigation. Drought stress coincided with high heat temperature during summer months.

Under drought condition, 26% reduction in tiller population was recorded. Maximum reduction was recorded in genotypes Co 20015, Co 21013 and Co 16030 while minimum in Co 20019 followed by Co 22021, Co 20016, Co 18022 and Co 22023. During maturity phase, overall mean plant height was 202 cm and drought stress caused reduction in plant height up to 20.5%. Maximum plant height was recorded in genotype Co 18022 (178cm), Co 20017 (172cm), Co 22021 (176cm) Co 20016 (171cm), Co 22023 (168cm), Co 22020 (167cm) with minimum reduction among the studied genotypes. Chlorophyll content in terms of spad values (µg cm^{-2}) **decreased up to 12% and a sharp rise in flavanol content was noticed under drought.**

Photosynthetic rate, transpiration rate and stomatal conductance were 25.72 µmol CO_2 m^{-2} s^{-1}, 9.51 mmol H_2O m^{-2} s^{-1} and 0.583 mmol H_2O m^{-2} s^{-1} respectively and reduced by 53.32%, 48.18% and 52.58% under stress. , Under drought stress, maximum number, of NMC were observed in entries Co 98014 (81.76), Co 22020 (80.41), followed by Co 22020 (80.41), Co 22021 (80.17), Co 22023 (80.15), Co18022 (76.15), Co 21014 (80.0), Co 20016 (75.54) and Co 17018 (71.35). Drought tolerant clones maintained up to 1.5°C cooler canopy than susceptible clones due to their deeper root system. Root character *viz*. root length and root volume were studied in pot culture. Seven genotypes (Co 20016, Co 17018, Co 18022, Co 98014, Co 22020, Co 21014 and Co 22021) recorded high cumulative root length, surface area and root volume.



Relationship between Chlorophyll and Flavonoid content in sugarcane genotypes under drought stress

Among juice quality parameters, overall experimental average of juice pol% was 16.95% at 8th month and no significant difference was recorded in irrigated and drought treatments. Clones Co 22020 (19.20%), Co 21012 (18.28%) and Co 20016 (18.10%), showed higher pol% than mean value.

(D. Pooja and Ravinder Kumar)

All India Coordinated Research Project (Sugarcane) - Subtropical zone

Breeding

Zonal Varietal Trial (NWZ)

Season (2023-24)

IVT Early: The experiment consisting of seven test entries and three standards (CoJ 64, Co 0238 and Co

05009) were evaluated for cane yield and juice quality traits. Co 20016 was the superior entry for sugar yield (20.84 t ha^{-1}), Cane yield (147.78 t ha^{-1}) and single cane weight (1.58 kg) over other test entries. It also had on par performance with best standard Co 0238 for cane yield (133.02 t ha^{-1}). The sucrose% at 10 M (20.08), CCS% at 10 M (14.12), pol in cane% (15.43) was also highest in Co 20016 which was on par with Co 0238. For cane yield, CoPb 20211 (119.4 t ha^{-1}) and CoLk 20201 (115.96 t ha^{-1}) were other promising test entries.

IVT Midlate: A total of eight test entries and three standards (CoS 767, CoPant 97222, Co 05011) were evaluated for cane yield and juice quality traits. Co 20017 was the best entry in terms of sugar yield, cane yield, sucrose% (12M), pol in cane% and single cane weight (SCW). It produced significantly higher sugar yield (20.15 t ha^{-1}), cane yield (141.93 t ha^{-1}) and SCW (1.55 kg) over rest of the entries and the best standard Co 05011 (14.36 t ha^{-1} CCS yield; 104.47 t ha^{-1} cane yield and 1.09 kg SCW). At harvest, its juice sucrose% (20.13) and pol% cane (15.62) was also highest and was on par with the best standard.

AVT Midlate I Plant: Seven test entries and three standards were evaluated for cane yield and juice quality parameters and Co 19017 (18.43 t ha^{-1}) was the best sugar yielder in the trial and also superior over the best standard CoPant 97222 (14.80 t ha^{-1}). Three entries Co 19017 (133.43 t ha^{-1}), CoPb 14214 (118.28 t ha^{-1}) and CoS 19235 (106.15 t ha^{-1}) had yield levels comparable with the best standard CoPant 97222 (111.72 t ha^{-1}). For juice quality, the sucrose% at harvest was highest in entries Co 19017 (19.79) followed by CoS 19235 (19.71) and CoPb 19182 (19.17)comparable with the best standard Co 05011 (19.10).

AVT Midlate II Plant: Co 18022 was the best sugar (21.66 t ha^{-1}) and cane (158.35 t ha^{-1}) yielder the trial comprising of six test entries and three standards among which Its performance was best standard Co 05011 recorded 15.84 t ha^{-1} CCS yield and119.34 t ha^{-1} cane yield. CoS 18231 (19.36%) followed by Co 18022 (19.34%) and CoS 18233 (19.13%) were the best entries for juice sucrose content at harvest with on par performance with best quality standard Co 05011 (18.98%).

AVT Midlate Ratoon: Co 18022 with 18.52 t ha^{-1} CCS yield and 154.89 t ha^{-1} cane yield was the best and superior performer over best standard CoPant 97222 (13.8 t ha^{-1} CCS yield; 116.87 t ha^{-1} cane yield). For sucrose% at harvest (11 month), the performance of test entries in descending order was CoS 18233 (18.52) followed by CoS 18231 (18.36), CoS 18232 (18.26), CoPb 18214 (17.90), CoPb 18213 (17.59) and Co 18022 (17.27). The test entries CoS 18233, CoS 18231, CoS 18232 and CoPb 18214 performed better, whereas, CoPb 18213 and Co 18022 had on par performance with the best standard CoS 767 (16.98%).

(Ravinder Kumar and M.R. Meena)

Pathology

Identification of pathotypes / races of red rot pathogen

A set of fourteen red rot isolates comprising eight reference pathotypes (CF01, CF02, CF03, CF07, CF08, CF09, CF11, CF13) and six local isolates *viz. Cf238* (BCM), *Cf238* (Bagha), *Cf238*(RNG), *Cf238* (Khumbhi), *Cf8436* (Karnal) and *Cf95422* were inoculated independently on a set of twenty-one sugarcane differentials by plug method. The overall disease reactions indicated that there was a clear pathogenic variation on test host differentials. Pathogenic reaction on test hosts showed that pathotype CF13 was more virulent followed by CF01, CF08, CF03, CF07, CF02, CF09 and CF11. Among the four *Cf238* isolates, RNG isolate was more virulent and exhibited susceptible reaction on nine host differentials. Further, isolate *Cf8436* (Karnal) succumbed to differential CoS 8436 only with intermediate to susceptible reactions, whereas, *Cf95422* (CoSe 95422) showed susceptibility to three host differentials. However, SES 594 showed complete resistance to all the test isolates.

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

Survey for the sugarcane diseases was carried out in the reserved area of ten sugar mills *viz.* Karnal, Yamunanagar, Bhadson, Shahabad, Assandh (Haryana), Mawana, Naglamal, Khaikheri, Liberheri, Barkatpur (UP). Red rot was noticed in variety Co 0238 in most of the sugar mills with mild to severe incidence. Pokkah boeng was noticed up to 35% in cultivated varieties. This year due to continuous dry spell yellowing in leaves followed by wilt was reported by many sugar mills, particularly in variety Co 0118. The maximum wilt incidence (upto 30%) was observed in Yamunanagar area.

Further, incidence of smut was recorded up to 15% in ratoon crop of varieties Co 0238 and Co 89003 in Karnal and Shahabad area, respectively. Mild incidence of top rot and YLD was also found in varieties such as Co 0118, Co 0238, Co 05011, Co 89003, CoH 160 and CoLk 14201.

Evaluation of IET / Zonal varieties for resistance to red rot

Forty-three IVT entries along with eight standard varieties were evaluated for red rot resistance by plug and cotton swab methods of inoculation using CF08 and CF13 isolates. Among the ten IVT early entries, CoPb 21211 expressed susceptibility to CF13 by plug method, whereas, of the IVT (Mid-late) entries, CoLk 21206 showed susceptibility to CF08 and CF13 isolates by plug method of inoculation. However, remaining test entries exhibited Resistant /Moderately Resistant reactions with both the isolates and methods.

Assessment of elite ISH clones for resistance to red rot

Evaluation of thirty eight clones comprising 20 ISH, three IGH, fourteen commercial hybrids and one water-logging tolerant clone was carried out for red rot resistance against CF08 and CF13 isolates. Of the test ISH clones 12 were rated resistant /moderately resistant, three moderately susceptible and four susceptible to CF08, while 13 clones found to be moderately resistant, four moderately susceptible and two susceptible to CF13 isolate. Further, clone IGH 823 exhibited susceptible reaction to CF13 and IGH 833 to CF08 isolate. One water-logging clone WL-10-85 expressed MR reaction to CF08 and susceptibility to CF13 isolate. Among the commercial hybrid clones only clone Co 0124 found to be susceptible to CF13 isolate and other test commercial hybrids were either resistant or moderately resistant to red rot.

Yellow Leaf Disease

Expression of yellow leaf disease (YLD) was monitored in 51 ZVT entries. Among the test entries, 41 were rated resistant or moderately resistant, five moderately susceptible and five namely, CoJ 64, CoLk 19202, CoS 20231, CoPb 19213 and CoS 767 showed susceptible to YLD.

Pokkah boeng

Fifty one entries of zonal varietal trial were screened for pokkah boeng incidence under natural conditions. Four entries were showed moderately susceptible and nine entries *viz*. Co 0238, CoPb21211, CoH 21261, CoPb 21184, CoH 21262, CoPb 20211, CoH 20261, CoPb 20181 and CoS 8436 showed susceptible reactions to PB. However, remaining entries showed R and MR reaction.

(M.L. Chhabra)

Entomology

Evaluation of Zonal varieties /genotypes for their reaction against major insect pests of Sugarcane

AVT Ratoon: In AVT-Ratoon crop, stalk borer incidence was the lowest (1.3%) in CoH 17262 and the highest incidence (26.7%) was recorded in the entry Co 17018. Intensity of the borer was 2.6 in CoPb 17215 and the highest intensity (14.4) was recorded in the entry Co 05011. Top borer incidence varied from nil in four entries (Co 17018, CoS 17233, CoS 17234 and CoH 17262) to 10.7% in CoPb 17215. Root borer incidence was the lowest (9.3%) in CoS 17233 and highest (21.3%) in CoLk 17204.

AVT 1st plant: In 12 entries of AVT-I at Karnal, stalk borer, top borer and root borer incidences were recorded at harvest. Stalk borer incidence varied from 2.7% in CoS 19235 to 18.7% in Co 05011. Intensity of the borer was minimum (2.14) in the entry CoPb 19212 and maximum (12.2) in the entry Co 05011. Top borer incidence varied from nil (CoPb 19213 & Co 19214) to 16% (CoLk 19201). Root borer incidence was the lowest (4.0%) in CoS 19232 and highest (17.3%) in four entries (Co 19017, CoLk 19201, CoLk 19204 & CoLk 19212).

AVT 2nd Plant: In AVT-II, out of 12 entries, the lowest (2.7%) incidence of stalk borer was recorded in Co 15023 and the highest (28%) was in CoS 18233. Intensity of the borer varied from 3.3 in CoLk 18202 to 11.7 in CoS 18233. Top borer incidence varied from nil (CoLk 18202) to 10.7% (CoPb 18213 &CoS 18233). Root borer incidence ranged between 2.7% (CoLk 18202) to 13.3% (Co 18022).

Evaluation of IVT clones

Out of 15 entries under IVT trial at ICAR-SBI-RC, Karnal, 14 entries were moderately susceptible (MS) while only one entry (CoLk 20201) was susceptible (S). Incidence of stalk borer varied from nil to 16%, however, top borer incidence varied from 4.0% (CoPb 20212) to 28% (CoLk 20201).

Survey and surveillance of sugarcane insect- pests

The field survey to sugarcane farmers fields in Shahabad Co-operative Sugar Mills, Saraswathi Sugar Mills, Yamunanagar and Mawana Sugars Ltd, was done along with the cane development personnel. Occurrence of root borer, top borer, stalk borer, white grub, whitefly, mite, mealybug, early shoot borer and pink borer were noticed. Top borer was the main pest noticed in the fields planted with the varieties Co 0238, Co 15023 and Co 05011, whereas, root borer was the major pest in the fields planted with the varieties Co 0118.

Survey in sugarcane farmers' fields

Monitoring of insect pests and bio agent's in sugarcane agro- ecosystem

A non-replicated experiment with sugarcane variety, Co 15023 was carried out and monitored the incidences of major insect pests and their bio agents of sugarcane at regular interval at the centre. Stalk borer, top borer and pink borer were the predominant pests present. Whereas, mealybug, termite, black bug and pyrilla were observed at low levels. Among the bio-control agents *Isotima javensis, Stenobracon deesae and Cotesia flavipes* are the major natural enemies present in this area.

Assessment of yield losses caused by borer pests of sugarcane under changing climate scenario

Yield loss due to stalk borer attack was assessed in an experimental plot with the popular variety Co 15023. At harvest, five millable canes in all five replications (spots) were counted, cut at the ground level, examined for the presence of injury symptoms, and the total number of internodes and number of internodes with bore holes were recorded and the three injury parameters *viz.*, percent incidence, percent intensity and infestation index were computed. To establish the relationship between yield characters and borer injury parameters, measurements of cane girth, cane length and cane weight were taken for sample canes (5) in treated plot and control. Similarly, cane juice samples were obtained at 12th months and qualitative analysis was done to find out the impact of borers infestation of juice quality traits; *viz.*, juice weight, brix, pol and purity in juice. The results indicated that yield and quality parameters in relation to the infestation parameters were not significant.

Impact of borer infestation parameters on yield and juice quality

S.No	% incidence	% intensity	Cane girth (cm)	Cane height (m)	cane weight (kg)	Juice wt	Brix (%)	Pol%	Purity
Treated plot									
1	0	0.00	2.72	2.4	7.80	4.35	22.99	88.0	91.3
2	20	14.28	2.66	2.65	7.85	4.5	22.97	91.09	94.65
3	40	8.33	2.72	2.5	7.1	4	23.17	91.18	93.83
4	60	6.00	2.64	2.65	7.2	4.25	22.49	86.37	91.82

S.No	% incidence	% intensity	Cane girth (cm)	Cane height (m)	cane weight (kg)	Juice wt	Brix (%)	Pol%	Purity
5	20	0.00	2.88	2.35	7.7	4.4	22.46	87.23	91.52
Mean	**28.0**	**6.67**	**2.724**	**2.51**	**7.53**	**4.3**	**22.816**	**88.774**	**92.62**
Untreated plot									
1	40	6.97	2.58	2.65	7.95	4.5	22.82	87.81	91.89
2	40	5.26	2.86	2.55	8.1	4.7	22.57	87.4	92.56
3	20	3.57	2.82	2.8	9.3	5.15	23.09	91.17	94.2
4	80	9.89	2.88	2.5	8.2	4.25	22.61	89.47	94.6
5	0	0.00	2.78	2.6	7.4	4.1	21.88	89.91	93.17
Mean	**36**	**5.14**	**2.78**	**2.62**	**8.19**	**4.54**	**22.60**	**89.15**	**93.28**

Evaluation of sugarcane germplasms under sub-tropical condition

In ISH & IGH clones, incidence of stalk borer varied from nil in six clones to 33.3% in 14-161. Intensity of attack was the highest in the clone 20-60-24. Seven clones were free from top borer attack and its incidence was maximum (27.3%) in PIR 1193. Root borer incidence varied from 4% (14-124, 14-132, 14-195) to 32.0% (14-196). Based on the incidence level, all entries except one (14-161) scored 'LS' reaction.

Borer incidence in ISH & IGH Clones at Karnal

S. No	Entries	Stalk borer		TB % incidence	RB % incidence	Ranking
		% incidence	% intensity			
1	14-58	0.00	0.00	0.00	8.00	LS
2	14-67	20.00	7.41	12.00	24.00	LS
3	14-90	0.00	0.00	24.00	12.00	LS
4	14-103	8.00	4.88	12.00	16.00	LS
5	14-114	16.00	7.81	4.00	12.00	LS
6	14-124	0.00	0.00	4.00	4.00	LS
7	14-132	0.00	0.00	4.00	4.00	LS
8	14-161	33.33	4.94	0.00	25.00	MS
9	14-196	16.00	6.06	0.00	32.00	LS
10	14-195	0.00	0.00	0.00	4.00	LS
11	14-474	11.76	9.52	0.00	29.41	LS
12	20-57-22	0.00	0.00	4.00	8.00	LS
13	20-60-24	8.00	11.11	0.00	12.00	LS
14	20-62-25	8.00	6.45	20.00	8.00	LS
15	ISH-524	4.00	10.00	0.00	12.00	LS
16	PIR 1193	9.09	7.69	27.27	27.27	LS

(P. Mahesh and K.P Salin)

Identification, characterization and verification of new sugarcane varieties for DUS testing

Maintenance of reference varieties (RV) of sugarcane: A collection of 171 sub-tropical sugarcane reference varieties was maintained in the field to verify Distinctness, Uniformity, and Stability (DUS) as an integral part of characterization based on DUS criteria. The following category DUS reference varieties are being maintained at the centre:

BO series-17 varieties; CoP series-7; CoB series-1; CoBln series 8; CoH series 12; CoJ series 5; CoPb series4; CoLk series 9; CoPant series 9; CoS series 50; CoSe series 14; CoPk 1; UP series 6 varieties, Co varieties 28.

Re-characterization of Reference Varieties: DUS traits of 171 RV maintained at ICAR-SBIRC, Karnal were verified /re-characterized during 2024-25 and the database of all the verified DUS reference varieties will be submitted to the PPV&FR Authority in tabulation format.

DUS testing for new sugarcane variety: First-year DUS (Distinctness, Uniformity, and Stability) testing for three candidate varieties —CoLk 15201, CoLk 15207, and CoLk 15466 was conducted along with the second-year DUS test for Co 16030. This trial includes reference varieties (CoPant 97222, CoPant 90223, CoSe 1434, Co 1158, Co 1148, Bo 130, and CoS 90268). Results from the first-year trial showed that the candidate varieties (CoLk 15201, CoLk 15207, and CoLk 15466) were distinct from each other and from the reference varieties and the population of these varieties was uniform. Similarly, 2nd year trial confirmed that the candidate variety Co 16030 was distinct from the reference varieties and displayed uniformity across two years. The claimed /essential characters recorded from the entry had shown stable performance during the second year as well.

(M.R. Meena and Ravinder Kumar)

ICAR-Seed Project, Sugarcane (RFS, Karnal)

The breeder seed crop was planted in 7 acres at the centre and in nearly 50 acres at FPSP farms. A total of 25,453.5 quintals of breeder seed was produced and supplied to various stakeholders. From the sale of the seed material Rs 18.19 lakhs were earned as revenue. Among the varieties, Co 15023 (8,040.55 quintals) and Co 0118 (16,131.1 quintals) were supplied in large quantity. The on farm seed production was 2,427.35 quintals whereas FPSP seed production was 23,026.15 quintals.

Details of Seed production and sale (in quintals) during crop season 2023-24

States	Co 0118	Co 0238	Co 13035	Co 15023	Co 16030	Co 17018	Total
On farm seed production and sale							
Spring 2024	595.15	249.75	6.4	515.15	155.7		1522.15
Autumn 2025	395.2	12.0		415.45	15.85	66.7	905.2
Total A	990.35	261.75	6.4	930.6	171.55	66.7	2427.35
C) Revenue generated (Rs)							796969/-
Farmers Participatory Seed Production and sale							
Spring 2024	11322.6	95.2	680.6	6054.2	-		18152.6
Autumn 2025	3818.15	-	-	1055.4	-		4873.55
Total B	15140.75	95.2	680.6	7109.6	-		25453.5
D) Institute's share (Rs)							742569/-
Total A+B	16131.1	356.95	687.0	8040.2	171.55	66.7	24398.64
Total Revenue (C+D)							Rs 1539538/-

Single Bud Setts Sale: A total of 1,09,678 single bud setts worth Rs 1,09,678/- of varieties Co 0118 (950), Co 0238 (6110), Co 05009 (50), Co 15023 (12425), Co 16030 (28750) and Co 17018 (61393) were produced and supplied to various farmers.

Settling production and sale: A total of 9,876 settlings of important varieties worth Rs 29,628/- were produced and sold to the various stakeholders.

Total Revenue generated: In total a sum of Rs 16,78,844/- was generated as revenue from the sale of planting material.

Production of tissue culture plantlets: The tissue culture plantlets of varieties Co 0118, Co 0238 and Co 15023 were produced through meristem culture. The plantlets were field transplanted as nucleus seed crop during September -October 2024. Nearly 7000 plantlets of varieties Co 15023 (5000) and Co 0118 (2000) are at hardening stage. The tissue culture plantlet production of latest released variety Co 17018 is also initiated.

(Ravinder Kumar and M.R. Meena)

Healthy seed production and mechanization of sugarcane agriculture - A farmer's participatory initiative (RKVY Haryana)

Supplied 415.45 quintals of seed cane of varieties Co 15023 (415.45 quintals), Co 0118 (134.2 quintals), Co 0238 (68.25 quintals), Co 16030 (105 quintals) and Co 17018 (61.30 quintals) to 50 stakeholders of Haryana state mainly farmers and sugar mills for the production of seedling material. Apart from this, for the faster spread of newly released varieties,single bud setts of Co 16030 (6050 No.) and Co 17018 (27653 No.) were also supplied to 11 and 37 farmers of Haryana respectively.

(Ravinder Kumar, M.R Meena, M.L Chhabra and Pooja)

Identification of salt tolerant sugarcane clones for commercial cultivation in Haryana (RKVY Haryana)

Screening of Co-canes under salinity stress: A CRBD experiment was conducted on eleven genotypes *viz.* Co 17018, Co 18022, Co 19017, Co 20015, Co 20016, Co 20017, Co 20018, Co 20019, Co 21012, Co 21013 and Co 21014 with standard Co 0238 in microplots under variable regimes of irrigation water salinity i.e. Control (best available water), EC_{iw} - 6 and 8 dS m^{-1}. Continued saline irrigation was given after 30 days of planting. A gradual increase was recorded in Na^+/K^+ ratio of leaf under salinity stress in all the studied clones. In leaves, Na^+/K^+ ratio increased from 0.125 (control) to 0.501 and 0.695 under 6 dSm^{-1} and 8 dSm^{-1}, respectively. Lipid peroxidation in terms of MDA content (µmol g^{-1} FW) was 0.776 and increased up to 53% under 8 dS m^{-1}. Average photosynthetic rate was 23.15 µmol CO_2 m^{-2} s^{-1} under normal irrigated control and 37% and 51.2% mean reduction was recorded in EC_{iw} – 6 and 8 dS m^{-1}, respectively. Clone Co 17018, Co 20016, Co 18022, Co 19017 and Co 20015 showed lees reduction than standard Co 0238 under 6 dSm^{-1} and 8 dSm^{-1}. Proline content increased from 1.09 to 1.84 under 8 dS m^{-1}. Significant reduction was recorded in SPAD chlorophyll content and clones Co 17018, Co 18022, Co 20016, Co 21012, Co 21014 showed less reduction, while maximum was recorded in Co 21013, Co 19017, Co 20019 and Co 0238. At maturity stage, average plant height was 232.83 cm under normal irrigated control, whereas 17.51% and 29.18% reduction were recorded under 6 and 8 dS m^{-1}, respectively. Genotypes Co 17018, Co 18022, Co 20016, Co 21014, Co 20017 and Co 20015 were identified as best under 6 & 8 dS m^{-1} salinity stress. Co 21012 was found tolerant in 6 dS m^{-1} and moderately tolerant under 8 dS m^{-1} salinity stress. Genotype Co 21013 was found to be susceptible under both levels of salinity stress.

(Pooja, Ravinder Kumar, M.R. Meena and M.L. Chhabra)

Improving water use efficiency and economizing water use in sugarcane cultivation in India (ISMA-funded)

To evaluate water saving agro-technique for sugarcane and to assess the irrigation water requirement of the most prominent cropping system in subtropical India system (Rice & wheat) studies were carried in ratoon crop and plant crop. Variety Co 0118 was planted in six treatments (drip irrigation, skip furrow, trash mulching, trench method, irrigation at critical stage & flat method) in RBD design. Micro irrigation system installed for further study. Results obtained from the study revealed that among all the treatments, drip irrigation system significantly saved 23 % water in sugarcane cultivation followed by skip furrow method (20.25%) in comparison to highest water consuming method (flat method). In rice crop, almost 38% higher water was consumed than sugarcane under subtropical condition

(Pooja and Ravinder Kumar)

Unraveling the molecular mechanism of early maturing responsive genes in sugarcane through transcriptome analysis

A comprehensive analysis of differentially expressed genes was conducted at the 8, 10, and 12th-month in Co 15023 and Co 0124, resulting in the identification of 1335 DEGs.. A total of 165 DEG was exclusively found at the 8-month stage of the crop, ot of which 79 DEGs were involved in the sucrose synthesis pathway. Further, gene expression analysis revealed that 60 DEGs were upregulated and specifically expressed in leaf tissue, of which 11 were unique to the leaf whereas 24 were unique to stem tissue. RT-PCR was performed with the same set of RNA samples and the expression of P-792865, P-979511, P-856134, P-1419305, and P- 1643844 were at par with the control SPSA and SPSB for sucrose metabolism. These transcripts were involved in sucrose phosphate synthase activity and sucrose synthase activity in sugarcane. SSR markers developed through transcriptome data were used for screening early and late maturing varieties. SSR maker, DN 4110 and DN 6395 has showed the polymorphism between the early and late maturing varieties. Differential gene expression analysis was also conducted to investigate genes involved in sugar transport during various stages. In leaf tissue, a total of 155 and 454 genes were unique to 8th and 10th month respectively and 37 were common. Similarly, in stem tissue 277 and 479 genes were unique to 8th and 10th month respectively and 25 were common for these stages. Gene related to sucrose metabolism *viz*., sucrose transport protein-5 (SuTp), sucrose synthase (Susy-7), sucrose hydrolases-5, kinases-2, sucrose phosphatase (SPP-3), sucrose phosphate synthase (SPP-7) and transferase-4 were identified. In addition to sugar transporters-38, triose phosphate isomerase-7, invertases-6 and phosphofructokinase-5 and Udp-Glc dehydrogenase-4 were also reported in early maturing variety. KEGG analysis provided insights to the metabolic pathway associated with specific genes. A total of 183 genes related to sucrose transport proteins, 230 genes associated with the SWEET transporters, and 259 genes involved in sugar transport, 254 genes associated with the photosynthesis pathway were identified in the early maturing genotype. The network analysis represented interactions among sugar transport proteins (STP), with SWEET11, SWEET12, and SUC3 playing central roles. These proteins work together to regulate sugar movement across cell membranes, crucial for maintaining cellular energy balance and responding to environmental changes.

(M.R. Meena)

Identification of climate resilient drought-tolerant sugarcane varieties suitable for Haryana state (RKVY)

Under the project, infrastructure such as the purchase of an instrument nanodrop spectrophotometer was completed. The construction of the Rainout shelter for screening drought-tolerant sugarcane clones is in under progress.

(M.R. Meena, Ravinder Kumar, Pooja and M.L. Chhabra)

5.7. ICAR-SBI Research Centre, Kannur

Breeding superior sugarcane varieties of different maturity with improved cane yield, quality and resistance to biotic and abiotic stresses

Breeding varieties resistant to waterlogging

Water logging (WL) tolerant clones WL 19-216, WL 19-241 and WL 19-254 from the biparental cross WL 15-1179 x WL 13-456 were evaluated in the Pre-Zonal Varietal Trial. The sucrose content of these clones in 10th month was 20.7 %, 20.4 %, and 18.1%, respectively. In the final clonal trial, 11 entries and three standards (Co 86032, Co 99006, and Co 62175) were evaluated for yield and quality traits. Entry WL 20-1027 recorded the highest NMC; the average NMC was 73. The average cane length (cm) was 247 which ranged from 201 to 266 cm. Except for two entries, others had cane length above the average. WL 20-1321 was the thickest cane. SCW (kg) ranged from 0.9 to 1.4, averaging 1.2 kg. The HR brix at the 7th month was 19.4 to 22.7 % with a mean value of 21.5 %. Nine entries (82 %) had HR brix above 20 %. The entry WL 20-1108 had the highest HR Brix of 22.7 %. Nine entries recorded Brix % in the 10th month, above the average value of 18.8. Clones WL 20-1027, WL 20-1065, WL 20-1169, and WL 20-1464 recorded 19.7, 19.2,18.7 and 18.3 % sucrose in the 10th month respectively. The entry WL 20-1027 recorded the highest cane yield of 115.1 t ha^{-1} followed by WL 20-1321 (110.9 t ha^{-1}). Clones WL 20-1027, WL 20-1321, WL 20-1169, and WL 20-752 had higher CCS yield plot^{-1} than standards. Based on overall performance clones WL 20-1027, WL 20-1321, and WL 20-1169 were selected for Pre- Zonal Varietal Trail.

In the second clonal trial, 42 clones were evaluated for yield and quality traits along with three standards (Co 86032, Co 99006, and Co 62175). Clones WL 21-4200, WL 21-3107, WL 21-2653, WL 21-3421, WL 21-4033 and WL 21-3436 had superior CCS yield per plot compared to the best standard. Based on the performance, 18 clones were advanced to the final clonal trial.

In the first clonal trial, 83 clones were evaluated for NMC, cane thickness and HR brix at 8th month with three checks. NMC ranged from 14 to 163, cane thickness from 1.6 to 2.9 cm and HR brix from 13.6 to 24.4 %. About 52 % of the clones recorded brix above 20%. Based on the performance, 43 clones were advanced to the second clonal trial. In the preclonal trial, 849 seedlings of 13 crosses were evaluated for NMC, cane thickness and HR brix at 8th month. Based on these, 250 clones were advanced to the first clonal trial. During the flowering season, 25 crosses were made utilizing waterlogging-resistant clones, Indian hybrids, and foreign hybrids.

Potential clones for waterlogging resistance maintained over the years were evaluated for yield and quality traits for registering as genetic stocks. Clones WL 18-586, WL 10-49, WL 17-854, WL 12-101, WL 15-1177, WL 15-1179, WL 10-85, WL 15-1463, WL 13-456, WL 01-69, WL 08-270, WL 16-498 and WL 18-749 showed better performance compared to Co 99006. Pokka boeng was recorded in clones WL 4524, WL 22-274, WL 22-278, WL 22-279, WL 22-632, WL 22-544, WL 22-499, and WL 22 – 290 which were under trials and in WL 13-349 and WL 17-1427 maintained as waterlogging resistant clones.

(M. Nisha, V. Krishnapriya, R. Gopi, B. Mahendran and V.G. Dhanya)

Enhancement of sugarcane germplasm and development of pre-breeding material

Utilization of germplasm resources for developing new genetic stocks

Clone GUK 17-301 (GUK 15-474 x WL 12-101) was identified as 'Co' cane (Co 24015) based on its performance from ICAR-SBI, Coimbatore. Three clones GUK 19-1395 (GUK 18-442 x WL 10-20), GUK 19-1421 (GUK 18-442 x WL 10-20), and GUK 19-1763(GUK 15-447 x Co 96011) were evaluated in the Pre-Zonal Varietal Trial and the sucrose content was 19.9 %, 19.1 % and 20.6 %, respectively. A final clonal trial was conducted with 12 clones of different back cross progenies of inter-specific crosses. GUK 20-401, GUK 20-473, and GUK 20-381 showed significantly higher CCS yield in the 11th month and were advanced to PZVT. The clone GUK-20-267 had the highest sucrose content of 18.5 % among the test clones.

In the second clonal trial, 36 clones were evaluated with two checks. Eight clones (GUK 21-1615, GUK 21-1636, GUK 21-1831, GUK 21-1147, GUK 21-851, GUK 21-1337, GUK 21-1217, and GUK 21-2275) were found promising for CCS yield. Six clones (GUK 21-833, GUK 21-960, GUK 21-1337, GUK 21-1615, GUK 21-1636 and GUK 21-1831 showed high brix (>22%) at 7th month. One hundred and sixty-two selected progenies of 14 different backcrosses of inter and intraspecific crosses were evaluated for cane thickness, brix at bottom, middle and top and NMC and tillering along with two check varieties. The NMC ranged from 2-35, HR brix at the bottom of the

cane ranged from 14.9-24.2 %, the middle 15.1-24.8 % and the top 14-24.1 %, and the cane thickness 1.8-3.6 cm.

Seedlings derived from interspecific were evaluated in the ground nursery and based on NMC, cane thickness and HR brix, selected clones advanced to clonal trail. Fifteen interspecific crosses were made using various *Saccharum* species and commercial hybrids. Among the progenies, NMC ranged from 3 to 41. HR Brix at the bottom of the cane ranged from 6.7-23.2 %, the middle 7.4-23.2 %, and the top 6.7-23.2 %. Red fleshed *S. robustum* accession NG 77- 132 was consequently found to be free from INB incidence for five years at the field level and identified as an INB-resistant source for the pre-breeding program.

(M. Nisha, B. Mahendran, R. Gopi and V.G. Dhanya)

Maintenance of world collection of sugarcane germplasm

Maintenance and evaluation of germplasm

Maintenance: The world collection of sugarcane germplasm comprising 3380 clones is being maintained in the field gene bank. These include *S. officinarum* (757), *S. barberi* (42), *S. sinense* (30), *S. robustum* (129), *S. edule* (16), S. *spontaneum* (79), Indian hybrids (1040), Foreign hybrids (614), *S. Spontaneum* IND collections (305), IA clones (130), allied genera and natural hybrids (152) and IND allied genera (88). Flowering of the germplasm accessions was less compared to the previous year and *S. sinense* clone failed to flower this season. The flowering ranged from 4.88% (*S. officinarum*) to 95.38 % (IA hybrids). The flowering percentage of other accessions were *S. spontaneum* (Exotic collection) 30.3%, Exotic hybrids 29.31 %, Allied genera (exotic collection) 31.3 %, *S. robustum* 11.18 %, Indian hybrids 26.03 %, *S. barberi* 14.28 %, *S. spontaneum* (IND) 20.32 % and IND allied genera 79.54 %.

Characterization: Exotic hybrids (614) available in the field gene bank were characterized for yield and quality parameters. The clones H 51-9002, POJ 2714, F 34-1428, H 45-369, Ragnar, Q45, POJ 2802 and LF 68-7639B recorded highest values for NMC, cane thickness, cane length, SCW, brix %, Sucrose %, yield and CCS yield/ plot, respectively. Country wise performance of the clones indicated that Barbados clones followed by Fijian clones recorded the highest NMC and the least cane producing clones were from Taiwan. Though there was uniformity among the clones for cane thickness the mean was highest for Mauritius clones whereas Clewiston, Barbados and canal point clones were comparatively thinner. Mean cane length was highest for Hawaiian clones followed by Barbados clones. The Hawaiian clones along with Mauritius clones performed better for SCW. Australian clones primarily bred for high sucrose recorded the highest brix % and sucrose % along with Clewiston, USA clones. The Australian clones also came in the top list for cane yield, CCS% and CCS yield /plot. Cane yield and CCS yield/plot of the Brazilian clones were highly commendable as they topped for both the traits in the study. Clones from Clewiston, USA had the highest CCS % and had good cane yield and CCS yield / plot. Mauritius clones also showed better cane thickness, cane yield and CCS yield/plot. Country-wise comparison of the clones revealed that Taiwan had poor performance for almost all the traits except for cane thickness. Indonesian clones were poor for most of the yield and quality traits showing their poor adaptability under the evaluated conditions.

The *S. spontaneum* accessions (79 international accessions-79 and 305 IND collection) are digitally characterized for crop stand in the field, cane characters, bud characters, and canopy.

Exchange of germplasm: One Indian hybrid, Co 293 supplied to ICAR-SBI Coimbatore to include in the arrowing plot as a source of internode borer resistance and one *S. officinarum* clone, Malabar to ICAR-SBI, Coimbatore for pathological studies.

(M. Nisha)

Monitoring of diseases and quarantine

Diseases recorded in germplasm clones during 2024 were ring spot, brown spot, stalk rot, rust, smut, *pokkah boeng* and freckle (SCBV) *etc.* A maximum ring spot disease scale of 5 was recorded in Cebu light purple, Gunjera, Naz of *S. officinarum*, and NG 77 129 of S. *robustum*, Co 660 of Indian hybrid and B 41-242, B 41-248, CP 29-103, CP 63-307 and CP 63-313 of foreign hybrids. Rust incidence was maximum in IND 81-20, IND 81-74, IND 81-82, IND 81-83 *S. spontaneum* clones. A total of 13 Indian hybrids, 4 foreign hybrids recorded rust incidence and a maximum rust rating of 8 was recorded in Co 62012. Smut was recorded in, Co 412, Co 703, Co 730, Co 726, Co 900, Co 828 and Co 851. The *S. officinarum* clones 57 NG 140 and 28 NG 10 recorded Stalk rot. *Pokkah boeng* was recorded in Ajax of foreign hybrids, Barbados white sport of *S. officinarum*. Only one plant in the clone 51 NG 153 of *S. officinarum* with *pokkah*

boeng with knife cut symptom was observed. Brown spot was observed on 57 NG 197, 57 NG 199 and IJ 76 326 *S. officinarum*, Co 62012 and PR 1047 foreign hybrid and among the IND collections of *S. spontaneum*, IND 81 – 81 recorded maximum brown spot with 5 disease rating. Freckle and chlorosis due to SCBV was found in Listada, Castilla, China, Guam A, Irang Malang, Hawai Original 36, Hawai Original 38 and Pilimoi 60 of *S. officinarum*

(R. Gopi)

Monitoring for pest's incidence, biological control of the pests

Sugarcane germplasm maintained at SBIRC, Kannur was monitored for pests and their natural enemies. Insect pests *viz*., Internode borer (INB), *Chilo sacchariphagus indicus*; Pink borer, *Sesamia inferens*; Sugarcane planthopper, *Pyrilla perpusilla* and leaf (web) mite, *Schizotetranychus krungthepensis* were found to be occurring at various ranges. In addition to that the sporadic infestation of armyworms, rice skipper, mealy bugs, scale insects, and sugarcane aphid, *Melanaphis sacchari* were noticed during the monitoring period.

INB incidence was noticed in less than 4 % of the accessions across all crop assemblages with per cent infestation ranging from 0-20 % and an average infestation of 8.94 % on cane basis. The soil-based application of insecticide, Fipronil 0.3 % GR was takenup at the time of sett planting as well as spot application for the management of pink borer. Pink borer incidence was noticed in less than 6 % of the accessions across all crop assemblages with the average percent infestation of 9.51 % on dead heart basis. Pyrilla population was effectively suppressed by the introduced ecto-parasiotoid, *Epiricania(=Fulgoraecia) melanoleuca* (Fletcher) (Lepidoptera: Epipyropidae) and the population remained at <0.1 nymphs and adults per leaf throughout the year. The web mite infestation was noticed in the germplasm maintained as potted plants and spraying of Spiromesifen 22.9 % SC (Oberon) @ 0.5 ml/ litre has effectively controlled the mite population.

Isolated incidence of fall armyworm, *Spodoptera frugiperda* and loreyi leafworm, *Mythimna loreyi* was noticed during the month of March-April. The isolated incidence of sugarcane aphid, *M. sacchari* with colonies showing mummification from the parasitoid, *Aphelinus sp*. was noticed. There was also activity of predators like syrphids and ladybird beetle, *Pseudaspidimerus sp.* effectively preying on sugarcane aphid colonies.

(B. Mahendran)

In-vitro conservation of germplasm and cryopreservation

Cryopreservation: Experiments on maintenance of germplasm *via* cryopreservation of true seeds/ embryonic axis was initiated. True seeds were dried to 10 percent moisture content and were exposed to liquid nitrogen for variable intervals of time. Seeds exposed to liquid nitrogen upto 1 hour retained their viability in TZ viability test. Further, the embryos were immersed in solutions of cryoprotectants (glycerol and sucrose), to promote a vitrified state during cooling. Embryos retained their viability up to 10 minutes of exposure to liquid nitrogen.

(V.G. Dhanya)

DNA fingerprinting of Saccharum officinarum clones

DNA fingerprints were developed for 60 *Saccharum officinarum* clones available in the collection using six primers and the DNA fingerprinting with other primers is in progress. The similarity among the clones ranged from 45 to 100 %. The complete similarity was observed in 31 clones.

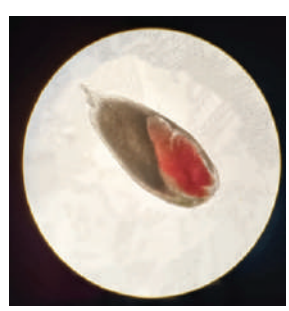
(M. Nisha)

Enhancing germination percentage and planting value in true seeds of *Saccharum* species.

Modified quick viability test protocol for true seeds of *Saccharum* sp.

Developed a Tetrazolium staining protocol for sugarcane seeds, which would serve as a rapid and fool-proof tool for viability screening of sugarcane seed lots. For the standardization of the protocol, three levels of incubation temperatures (30, 35, and 40 °C), three concentrations of TTZ (0.1 %, 0.5 %, and 1.0 %, with pH 7.0) and five different durations of soaking in TTZ (1 h, 2 h, 3 h, 4h and 5 h) were attempted and each treatment was replicated thrice.

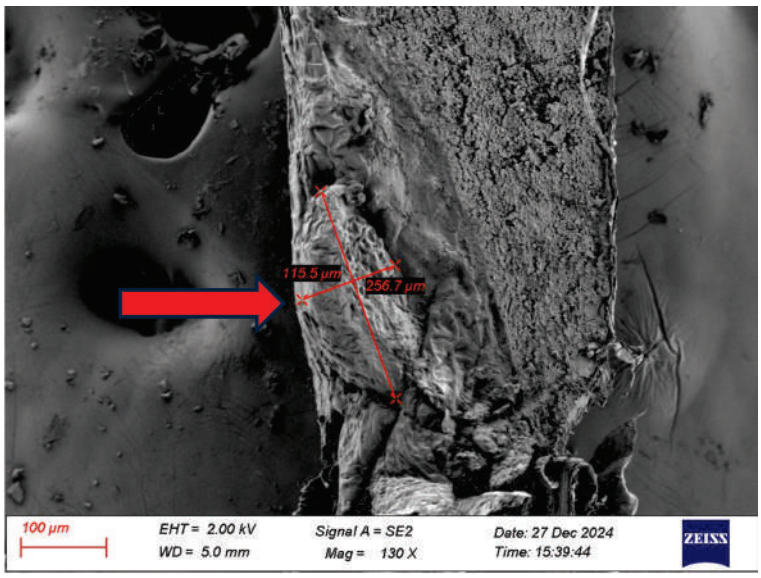
True seeds with lack of visible staining pattern, indicating non viability



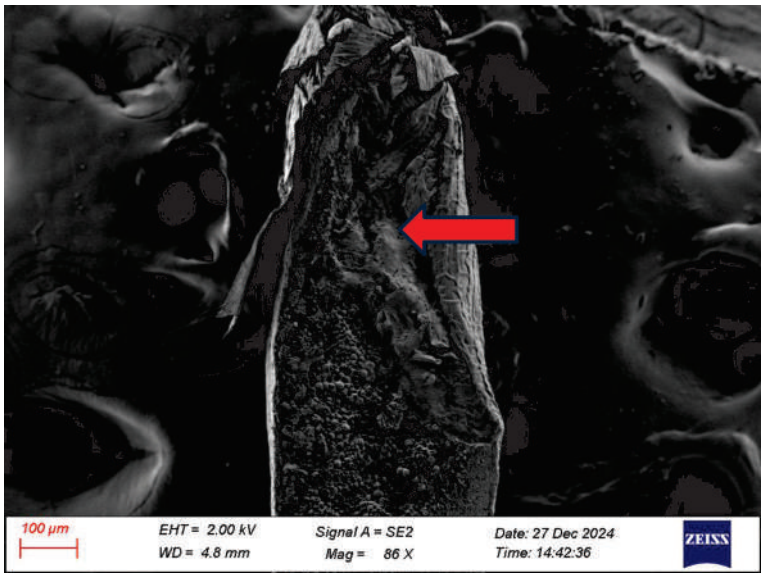
True seeds with pink-red staining of embryo portion, indicating the possible viability.

Embryo dehydration as an indicator of seed recalcitrance in *Saccharum* sp.

An experiment was conducted to study the pattern of desiccation sensitivity in true seeds of *Saccharum* sp. When true seeds were exposed to ambient atmospheric conditions (at variable intervals of time), a rapid decline in the percentage of germination was observed. Seeds when exposed to more than 5 hours at 28 °C temperature, exhibited signs of embryo dehydration which indicated their recalcitrant storage behaviour.



SEM image showing visible embryo, immediately after harvest



SEM image indicating a lack of embryo, after 5 hours of exposure to ambient atmospheric conditions

Enhancing percentage of germination in true seeds of *Saccharum* sp.

True seeds of *Saccharum* sp. exhibited less than 2 percent germination under standard atmospheric conditions. To enhance its germination percentage, seeds were collected three weeks after anthesis from 20 clones each of *S. spontaneum* and *S. officinarum*. After initial moisture analysis, they were exposed to 15 different treatment combinations in 3 replicates of 50 seeds each. From the results, it was observed that GA_3 acts as a gemination promoter in true seeds of *Saccharum* sp.

(V.G. Dhanya, M. Nisha and M. Alagupalamuthirsolai)

Standardization of true seed production technique through developing homozygous parental lines and apomixes

Inbreeding

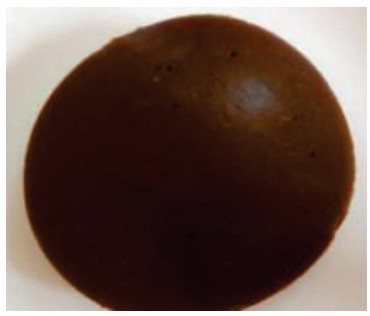
One hundred and six self progenies from eight exotic hybrids and three WL clones of first to 5th generation selfing were evaluated for yield and quality traits along with the parents. Selfing was attempted in five clones of 5th generation selfing.

(A. Anna Durai, M. Nisha and T. Lakshmi Pathy)

Development of sugarcane-based value-addition products and technologies (Kannur)

The technique for preparing sugarcane juice-based millet halwa is standardized. Based on the sensory evaluation, sorghum-based halwa was found to be best. The method for preparing chocolate based on sugarcane juice was standardized. Powder jaggery was found to be suitable for chocolate preparation. Efforts were also made to prepare sugarcane juice-blended fruit squash. The squash prepared using passion fruit and liquid jaggery was the tastiest based on sensory evaluation.

Liquid jaggery blended passion fruit squash



Sorghum halwa using powder jaggery as sweetener

Chocolate using powder jaggery as sweetener

(M. Nisha, B. Mahendran and V.G. Dhanya)

5.8. ICAR-SBI Reseach Centre, Agali

Enhancement of sugarcane germplasm and development of pre-breeding materials

Germplasm maintenance, hybridization and off-season nursery at Agali

Germplasm maintenance:

A total of 1394 germplasm lines including Co canes, Co allied clones, exotic hybrids, inter-specific and inter-generic hybrids, active collection of *Saccharum officinarum*, *S. barberi*, *S. sinense*, *S. robustum*, *Erianthus* spp, *Sclerostachya* and *Narenga* are clonally maintained in the field.

Flowering during 2024 season: Out of 1394 germplasm lines, 877 accessions flowered during 2024 crossing season. The flowering intensity across the clones during 2023 season is 62.91%. Among the 205 *S. officinarum* clones maintained at National Distant Hybridization Facility (NDHF), Agali, 48 clones (23.41%) flowered during 2024 season. Seven clones of *S. sinense*, five clones of *S. robustum* and two clones of *S. barberi* flowered during the season. Intensity of flowering in Co canes and Co-allied clones is 80.57%. Anthesis (opening of spikelets) began from 17 September, 2024 and lasted up to 28 December, 2024. *S. officinarum* clones *viz*., Mongetgayam and Naz, Exotic clones *viz*., LF 89-2064, Suphan-50 and KM 436 were the early flowering clones flowered during 3rd week of September 2024.

Hybridization: During 2024 crossing season, a total of 254 crosses were made at NDHF at Agali. This year 21 AICRP (S) centers (Anakapalle, Buralikson, Cuddalore, Faridkot, Lucknow, Kapurthala, Mandya, Motipur, Navasari, Padegaon, Pantnagar, Powarkheda, Pune, Pusa, Sankeshwar, Seorahi, Shahjahanpur, Rudrur, Thiruvalla, Uchani and Vuyyuru) visited the center and utilized the facility. A total of 105 crosses were effected for the participating centers.

First Clonal trial: 36 clones were selected from 150 base population in 1st clonal stage based on Brix% of 22% and better cane parameters. Most of the selections were from crosses involving Co canes with ISH/IGH and Co-allied clones.

Second clonal trial: Eight clones were selected from the second clonal stage based on the superior cane parameters and juice sucrose% of >21% at harvest and promoted to PZVT stage. The clones will be included in 2024 PZVT Trial.

Off Season Nursery: ICAR-NRC Banana, Trichy, under the project 'Improvement of banana through conventional breeding' maintaining 750 plants from 75 unique and breeding potential varieties/accessions at Agali. a total of 120 bunches have hybridized with various cross combinations and A total of 747 hybridized seeds have collected from 30 successful hybridized bunches.

(R.T. Maruthi and A. Anna Durai)

DUS testing of sugarcane (Agali) (PPV&FRA)

Maintenance of Reference varieties: A total of 246 Tropical sugarcane Reference Varieties (RV's) were maintained through clonal propagation at Co-operating Centre (ICAR-SBI RC, Agali). Single bud-derived settlings of all RVs were raised in polybags during third week of January 2024 and the settlings were transplanted in the main field on 04 March 2024. Each RV was planted in two rows (6 m long) with spacing of 0.9 m. All the recommended cultural practices were followed for a disease-free crop at the Centre.

Multiplication of seed cane of candidate varieties: During 2023-24, the Centre received seed canes of 2 new varieties (NV), namely VSI 08005 (VSI 12121) and Phule Sugarcane 13007 (MS 14082), received from VSI, Pune, and CSRS, Padegaon respectively, for the conduct of the DUS test at Agali Centre. The seed canes of these varieties were multiplied during the reported period.

The two candidate varieties along with their respective Reference Varieties (RVs) - Co 8347, Co 94008, Co 62175 for VSI 08005 and CoC 773, 93 V 297, CoM 0265 for Phule Sugarcane 13007 were raised in polybags during the fourth week of January 2024. These were subsequently transplanted into the field during 5 March, 2024 for first year DUS testing.

Results of DUS test for NV's: During 2023-24 season, at Agali centre DUS test was conducted for 5 varieties namely, Phule-11082 (CoM 11082), Phule Sugarcane 15012 (MS 17082), CoA 14321, CoA 14323, and CoM 0265.

First-year DUS testing: (i) Phule-11082 (CoM 11082) was found distinct from the RVs (Co 8347, Co 8371, CoA 89081 and Co 7805) for DUS traits like, plant growth habit, hairiness, shape of ligule, inner auricle, leaf blade curvature, adherence of leaf sheath, internode colour exposed to sun and prominence of growth ring. ii) Phule Sugarcane 15012 (MS 17082) was distinct from the RVs (Co 8347, Co 8371, Co 853 and Co 6304) in respect of DUS traits *viz*., plant growth habit, hairiness, shape of

ligule, inner auricle, internode colour (exposed to sun), internode shape, rind surface appearance, waxiness, bud groove and bud tip in relation to growth ring.

Second year DUS testing: (i) The candidate variety CoA 14321 (NV) was distinct from the RVs (CoG 93076 and Co 97009) in respect of DUS traits *viz*., plant growth habit, hairiness, shape of ligule, inner auricle, internode zig-zag alignment, rind surface appearance and waxiness. (ii) The candidate variety CoA 14323 (NV) was distinct from the RVs (CoC 773 and Co 7527) in respect of DUS traits *viz*., growth habit, ligule, inner auricle, leaf sheath curvature, internode shape, internode zig-zag alignment and growth crack. Though the candidate varieties CoA 14321 (NV) and CoA 14323 (NV) were distinct from their respective reference varieties, they differed from each other only for the traits *viz*., shape of ligule and leaf blade curvature. (iii) The Extant variety CoM 0265 (EV) was distinct from the RVs (Co 87044 and CoN 07072) in respect of DUS traits *viz*., hairiness, ligule, inner auricle, colour of dewlap, leaf blade curvature, adherence of leaf sheath, internode shape, zig-zag alignment, growth crack, shape of bud, bud groove and bud tip relation to growth ring.

(R.T. Maruthi and R. Karuppaiyan)

06

Education & Training

6.1. Education:

M.Sc./Ph.D Programme

- Mrs. R. Vigneshwari (Guide: Dr. R.M. Shanthi) was awarded Ph.D degree by Bharathiar University w.e.f. 15 January 2024 for her thesis work entitled "Genetic analysis of full-sib families for commercial cane sugar yield and development of genic microsatellite markers for sucrose metabolic pathway enzymes in sugarcane".
- Mrs. Amala Mol D (Guide: Dr. A. Ramesh Sundar) was awarded Ph.D degree by Bharathiar University w.e.f. 18 April 2024 for her thesis work entitled "Deciphering the functional roles of candidate secreted molecular signatures of *Colletotrichum falcatum* - C*f*EPL 1, C*f*PDIP and C*f*BYS 1 during their interaction with sugarcane".

Project work /Training programme for students

- *UG/PG Project work*: During 2024, 20 PG students belonging to various disciplines (Biotechnology, Biochemistry, Botany, Microbiology, Food Science, Zoology, Life Science, Bioinformatics and Genetic Engineering) studying in colleges of Tamil Nadu and Kerala underwent three-month project work at the Institute.
- *Exposure Training*: In total, 214 students underwent 15/21/30 days exposure training (Internship) in the aspects of Agricultural Biotechnology, Microbiology, Plant Pathology, Entomology, Plant Physiology and Nematology.
- A total revenue of Rs.14,54,000/- was generated through the fees paid by the project students.

Deputation abroad

- Dr. R. Valarmathi, Scientist, completed the DST-SERB 'International Research Experience (SIRE)' Fellowship program, GoI at School of Plant, Environmental Sciences, Louisiana State University Agricultural Centre, USA for a period of six months from 08 October 2023 to 07 June 2024
- Dr. V. Krishnapriya, Scientist received the International Travel Support from the Science and Engineering Research Board, Department of Science and Technology, New Delhi to attend the 12th International Symposium of the International Society of Root Research Roots [&Roads] to a sustainable future (12 ISRR 2024) held at Leipzig, Germany from 02 to 07, June 2024

- Dr. V. P. Sobhakumari, Principal scientist, was awarded CIRAD fellowship under 'Incentive Action 2024 Welcoming partners from the South and Developing scientific skills' to learn new advanced techniques in FISH at CIRAD, France under the guidance of Dr. Angelique D'Hont, CIRAD from 21 October 2024 to 20 December 2024.

Ph.D. Guidance/Evaluation

- Dr. A. Jeevalatha acted as an External examiner for the evaluation of the Ph.D. thesis work entitled "Detection of *Ralstonia solanacearum* (smith), an inciting agent of bacterial wilt of potato and its biological management" submitted by T. Archana from TNAU, Coimbatore.
- Dr. A. Jeevalatha acted as an External examiner for the evaluation of the Ph.D. thesis work entitled "Characterization of cucumber mosaic virus (CMV) infecting *Capsicum annuum* L. and identification of resistant source through screening of *Capsicum* spp. germplasm" submitted by R. Madhubala from TNAU, Coimbatore.
- Dr. A. Anna Durai served as External Examiner to conduct of viva-voce of PhD thesis work entitled "Development of Climate resilient rice hybrids capitalizing diverse heterotic pools in rice (Oryza sativa)" on 02 August 2024 at School of Post Graduate Studies, Tamil Nadu Agricultural University, Coimbatore
- Dr. Puthira Prathap, D served as External Examiner for adjudication of the Ph.D. thesis submitted by Ms. Palaparthy Steffi of Department of Agricultural Extension, College of Agriculture, Kerala Agricultural University, Vellayani, during February 2024.
- Dr. Puthira Prathap, D served as External Examiner and conducted the PhD viva voce of Ms. Namitha Raghunath of Department of Agricultural Extension, College of Agriculture, Kerala Agricultural University, Vellayani, on 21 March 2024.

6.2. Training and Capacity building

6.2.1 Training Programme organized

Coimbatore

- A One-day exposure training was organized to a group of 63 teachers from different schools across the state of Tamil Nadu at ICAR-SBI on 9 January 2024 as part of the Teachers Proficiency Development Programme of SCERT (State Council of Educational Research and Training), Govt. of Tamil Nadu.
- A 21 day ICAR sponsored Winter School on "Climate Smart Sugarcane Agriculture for Food and Energy Security in India" was organized during 31 January - 20 February 2024.

Participants of Winter School

- A Two-day Training on "Scientific Sugarcane Cultivation" to the sugarcane farmers of Miraj Taluk, Sangli District, Maharashtra was organized during 22-23 February 2024.
- A Training programme on Improving Sugarcane Productivity (TISP-2024) was conducted on 28 March 2024 for 25 Scheduled Caste sugarcane farmers of Andhra Pradesh.
- A demonstration on Sugarcane sett cutter planter was organized in the Farmers meeting at Thirukoilur on 05 April 2024 to sensitize the farmers and entrepreneurs.
- A Training programe on "Quality seed production" was organized to farmers and staff of K. J. Somaiya Institute of Applied Agricultural Research, Sameerwadi on 30 April 2024.
- A "Hands on Training on Plant tissue culture Techniques" was imparted to students at Department of Plant Biotechnology, Tamil Nadu Agricultural University on 15 May 2024.
- A Demonstration on DSMS (Digital Soil Moisture Sensor) and Sugarcane Sett Treatment Device (STD) was organized to 20 farmers of Coimbatore district on 15 July 2024 at the Institute.
- An awareness camp cum training on Caring for Soils and an essay competition were organized

in connection with World Soil Day to create awareness among the students on 23 November 2024 at Kumaraguru Institute of Agriculture, Erode.

- A Five day Training cum demonstration on "Mechanized priming Technology for Healthy Nursery Programme and Disease Management through Sett Treatment Device" was organized from 25 to 29 November 2024 in UP Sugar Mills and UPCSR, Shahjahanpur.
- A two-day Training on 'Sugarcane Production' (TSP-24) was organized for the sugarcane farmers of Palus Taluk, Sangli district, Maharashtra during 19-20 December 2024.

At Karnal

- ICAR-SBI, Regional Centre, Karnal imparted four one day trainings for the farmers on 30 and 31 January, 16 October and 10 December 2024.

Farmers' Training Programme at ICAR-SBIRC, Karnal

- A six - day farmers training to progressive sugarcane farmers of UP was organized at ICAR-SBI, Regional Centre, Karnal during 05-10 February 2024. It was sponsored by Lal Bahadur Shastri Ganna Kisan Sansthan, Lucknow.

Training for progressive sugarcane farmers of UP

- One-day training programme for the staff of participating sugar mills in subtropical region on 19 October 2024 (Saturday) at ICAR- Regional centre, Karnal, Haryana under ISMA-ICAR SBI collaborative research project, ICAR SBI). Sixteen Mills participated @ two Cane officials / mill covering Bihar, Uttar Pradesh, and Haryana states.

Training for Department Officials at ICAR-SBIRC, Karnal

- An Interaction cum Training Programme was organized for the Agriculture officials of UP by CCS HAU, Extension Education Institute, Nilokheri, Haryana at ICAR-SBIRC, Karnal on 23 October 2024.

6.2.2 Training programme attended

- Dr. G.S. Suresha, Senior Scientist, attended a 21-day CAFT training programme on 'Recent advances for Biocatalyst for biomass derived renewable chemicals' organized by Dept. of Microbiology, Tamil Nadu Agricultural University, Coimbatore during 15 December 2023 – 04 January, 2024.
- Dr. R. Manimekalai, Principal Scientist, attended CAFT training programme on 'Statistical and Computational advances for Bioinformatics data analysis in agriculture: Practical aspects" held during 02-22 January 2024 at ICAR-IASRI, New Delhi.
- Dr. M.R. Meena, Senior Scientist; Dr. V. Sreenivasa, Senior Scientist and Dr. H.K. Mahadeva Swamy, Scientist, attended a seven day online training programme on 'Recent advances in data analysis and application' organized by ICAR-IASRI, New Delhi during 16-22 January 2024.
- Dr. R. Gobu participated in 21 days winter school on "Climate Smart Sugarcane Agriculture for Food and Energy Security in India" 31 January - 20 February 2024 organized by ICAR- Sugarcane Breeding Institute, Coimbatore.

- Smt. R. Nirmala, CTO and Shri. S. Karuppasamy, TO attended an Online short course on "E-Governance tools and applications in ICAR" organized by ICAR-IASRI during 08-14 February 2024.
- Dr. R. Selvakumar, Principal Scientist attended a CAFT training programme (online) on 'Development of AI based Android Applications in Agriculture' during 5-25 March 2024 organized by ICAR-IASRI, New Delhi.
- Dr. P. Geetha, Senior Scientist and Dr. S. Anusha, Scientist attended a 10 day ICAR sponsored short course on 'Futuristic strategies and options for profitable organic farming' during 6-15 March 2024 organized by Nammazhvar Organic Farming Research Centre at TNAU, Coimbatore.
- Dr. T. Ramasubramanian, Principal Scientist and Dr. P.T. Prathima, Senior Scientist, attended a one day NABL refresher training programme held at Chennai on 23 March 2024.
- Dr. Vinayaka and Dr. Shweta Kumari, Scientists successfully completed Professional attachment training (PAT) for a duration of three months at International Institute of Information Technology, Hyderabad (17 November 2023 to 14 February 2024) and Indian Institute of Science, Bangalore (20 November 2023 to 19 February 2024).
- Dr. C. Sankaranarayanan, Principal Scientist and Dr. B. Singaravelu, Principal Scientist, attended a training programme on 'Identification of *Phytophagus Scarabs*' during 20-25 May 2024 held at Department of Entomology, UAS, GKVK, Bengaluru, organized by ICAR-AINP Soil Arthropod Pests.
- Dr. P. Murali, Principal Scientist, attended a capacity building programme on 'Building successful incubation ecosystem" organized by ICAR-NAARM during 3-5 July 2024 at ICAR-NAARM, Hyderabad.
- Dr. R. Selvakumar, Principal Scientist and Dr. H.K. Mahadeva Swamy, Scientist, attended an online training programme on "Phenomics and high-throughput phenotyping: Dissecting traits for abiotic stress tolerance" organized by ICAR-IARI during 25-30 August 2024.
- Shri. P. Kannan, SSS, attended a training on "Honey bee farming" 7 October 2024, organized in TNAU, Coimbatore.
- Dr. D. Puthira Prathap, Principal Scientist, attended Management Development Programme (MDP) on "Leadership Development for Heads of Extension and Social Sciences" held at Hyderabad during 14-18 October 2024, organized by ICAR-NAARM.
- Dr. H.K. Mahadeva Swamy, Scientist and Dr. Shweta Kumari, Scientist, attended the Hands-on training in Genomic Selection at TNAU during 14-18, October, 2024.
- Dr. T. Arumunaganathan, Principal Scientist, attended an ICAR-HRM training on "Smart Digital tools for sustainable agriculture" organized by ICAR-Central Research Institute for Dryland Agriculture, Hyderabad, during 15-24 October, 2024.
- Dr. R. Valarmathi, Scientist, attended a Hands-on training on 'Genome Editing – Basic principles and Practices" organized under the project 'Enhancing Climate Resilience and Ensuring Food Security with Genome Editing Tools' organized during 02-06 December 2024 at ICAR-IARI, New Delhi.

6.2.3 Resource Person in Training/Workshop/ Seminar/Meeting

- Dr. M. Nisha participated as Chief guest for inauguration of Biotechnology Association, Chinmaya Arts and Science College for Women, Chala, Kannur on 01 February 2024.
- Dr. P.T. Prathima delivered an invited Lecture on the occasion of International Day of Women and Girls in Science at the NGP College of Technology, Coimbatore on 09 February 2024.
- Dr. P.T. Prathima delivered an invited lecture to students of Biotechnology Department of Biotechnology, Vivekanandha Arts and Science College for Women, Salem on 19 February 2024.
- Dr. D. Puthira Prathap served as Resource person in Scientific Writing Workshop of Tamil Nadu Agricultural University, Coimbatore, 5-7 March 2024.
- Dr. Vinayaka delivered a lecture on 'Design of Experiments' on 22 March 2024 at short course on "Statistical Data Analysis for Agricultural Research" held during 18-22 March 2024 at UAS, Raichur.
- Dr. D. Puthira Prathap served as Chairperson in Technical Session of International Seminar on

"Sustainable Urban Agricultural Practices and Community-Resilient Cities" during 22-23 March 2024 at College of Agriculture, Vellayani, Kerala Agricultural University.

- Dr. D. Puthira Prathap served as Resource person in Multistakeholder Workshop on Analysing the Impact of Pradhan Mantri Kisan Samman Nidhi Programme (PM KISAN) in Southern States of India" organized on 25 March 2024, at Tamil Nadu Agricultural University, Coimbatore.
- Dr. D. Puthira Prathap participated as Chief guest for the inauguration of ELZIA-2024, a National Level Technical Symposium at Hindusthan College of Engineering & Technology, Coimbatore, and extolled the values of team work, on 27 March 2024.
- Dr. T. Rajula Shanthy participated in the Scientific Advisory Committee meeting of Avinashilingam KVK, Coimbatore on 28 March 2024.
- Dr. R. Manimekalai served as a keynote speaker in International conference on "Advances in Plant Biology - From Genome Editing to Sustainable Development." Presented on Genome editing to improve the sugarcane varieties organized by Vietnam Academy Sciences and Technology at International Centre for Interdisciplinary Science and Education, 07 Science Avenue, Quy Nhon city, Binh Dinh province, Vietnam, Quy Nhon during 8-14 April 2024.
- Dr. A. Jeevalatha delivered a Guest lecture on "Detection and characterization of *Phytophthora* species infecting black pepper" at CPPS, TNAU, Coimbatore on 26 April 2024.
- Dr. C. Palaniswami, Dr. P. Malathi, Dr. P. Mahesh and Dr. C. Sankaranarayanan served as Resource persons of the seminar on Sugarcane Production Technology organized by Bannari Amman Sugars Ltd at Satyamangalam on 05 June 2024.
- Dr. D. Puthira Prathap served as resource person, Session on *Career Opportunities in Agriculture*, Career-orientation workshop, Vanavarayar Institute of Agriculture, 07 June 2024.
- Dr. Vinayaka delivered a Guest lecture on the topic of 'Graphical analysis for scientific writings' during 4 July 2024 at Department of Floriculture & Landscaping, TNAU, Coimbatore.
- Dr. R. Selvakumar delivered a lecture for the Agricultural Engineering Department, Govt of Tamil Nadu under RKVY project on 15 July 2024.
- Dr. A. Jeevalatha delivered Guest lecture on "Application of bioinformatic tools and AI in Plant Pathology" at CPPS, TNAU, Coimbatore on 26 July 2024.
- Dr. R. Manimekalai delivered an invited talk on "Genome Editing for the Sustainable Improvement of Sugarcane" in International Conference on Building a Resilient and Sustainable Global Sugar & Bio-energy Industry: Transforming ASEAN Sugar Sector at Quy Nhon, Vietnam during 16-19 September 2024.
- Dr. V.G. Dhanya served as Resource person in the value-added course 2024 at Department of Biotechnology, University of Calicut on 25 November 2024.
- Dr. M. Nisha served as Chief Guest in 'National Seminar on Recent Advances in Biotechnology (RAB 24)' at Sir Syed Institute for Technical Studies, Thaliparamba on 27 November 2024.
- Dr. D. Puthira Prathap served as Resource Person in the one-day workshop on "Research Prioritization and Publications in Agricultural Extension" on 28 November 2024 and delivered a Guest lecture on 'Publishing in high rated journals".
- Dr. D. Puthira Prathap served as Nominated member, Scientific Advisory Committee, MYRADA ICAR-KVK, Erode, 29 November 2024.
- Dr. V.G. Dhanya acted as judge for the RSBVP KVS Regional level exhibition conducted on 6-7 December 2024 at KV, Kannur.
- Dr. M. Nisha served as Resource person for the Secondary School Teachers Transformation Programme-2024 by Directorate of Higher Secondary Education and SCERT, Govt. of Kerala on 12 December 2024.
- Dr. P.T. Prathima served as subject expert for Dr. NGP College for arts and science Board of Studies for the year 2022-2025.

07

Awards & Recognition

- Alarmelu, S received "SSRD Best researcher award" in the AGM Meeting of the Society for Sugarcane Research and Development held on 26 March 2024 at ICAR-SBI, Coimbatore.
- Alarmelu, S received the "Sugar Industry Excellence Award" for sugarcane improvement and variety development from The International Association of Professionals in Sugar and Integrated Technologies (IAPSIT) China, Society for Sugar Research & Promotion (SSRP) and Sugar Technologist's Association of India, STAI, New Delhi in '8th IAPSIT International Sugar Conference ISC-2024 & Sugarcon 2024' held during 16-19, September 2024 in Quy Nhon, Vietnam.
- Alarmelu, S et al. received "Best Oral paper award" in National Conference on "Plant Health for Food Security: Threats and promises" held during 1-3 February at ICAR-IISR, Lucknow.
- Amshaveni, P received the Certificate of Appreciation under Technical Category for the Year 2024 during the Foundation Day of ICAR-SBI held on 25 October 2024.
- Anusha, S., Geetha, P and Krishnapriya, V received "First prize" for poster entitled '*Selectivity and efficiency of herbicide application in sugarcane*' in 3rd International Conference and Exhibition on "Sustainability: Challenges and Opportunities in Global Sugar Industry" held during 12-14 January 2024 at Vasantdada Sugar Institute, Pune.
- Appunu, C received "Best Presentation Award" for the paper entitled "CRISPR/Cas9 mediated genome editing for improved tolerance to drought and salinity stresses in Sugarcane" by Appunu Chinnaswamy, S.R Harish Chandar, Sruya Krishna Sakthivel, Sreenivasa Venkatrayappa, Mahalakshmi Subramanian and Prakasika Balakrishnan in the 3rd International Conference & Exhibition on Sustainability: Challenges & Opportunities in Global Sugar Industries held during 12-14 January 2024 at VSI, Pune.
- Appunu, C received "Best presentation Award" for the paper entitled "Vacuole isolation in sugarcane stem for Agriculture and Bio Industrial Innovations" by Swathi T, Appunu Chinnaswamy, et al., in the International Conference on "New Horizons in Bioengineering: Fostering Academia – Industry Partnership (ICB-2024)" organized by School of

Bioengineering, SRM Institute of Science and Technology held during 14-16, February, at Chennai.

- Appunu, C received the Fellow of Society for Sugarcane Research and Improvement (SSRP), New Delhi for the year 2024.
- Arun kumar, R received the Certificate of Appreciation under Senior Scientist Category for the Year 2024 during the Foundation Day of ICAR-SBI held on 25 October 2024.
- Chinnaswamy, P received the Certificate of Appreciation under Supporting Staff Category for the Year 2023 during the Foundation Day of ICAR-SBI held on 29 February 2024.
- Eswari received the Certificate of Appreciation under Supporting Staff Category for the Year 2024 during the Foundation Day of ICAR-SBI held on 25 October 2024.
- ICAR-SBI participated in the State Level Farmer's Day held at Tamil Nadu Agricultural University, Coimbatore during 26-29 September 2024 and received the "Best Stall Award".
- Kandasamy, S received the Certificate of Appreciation under Supporting Staff Category for the Year 2023 during the Foundation Day of ICAR-SBI held on 29 February 2024.
- Karuppaiyan, R received "SSRD Fellow award" in the AGM Meeting of the Society for Sugarcane Research and Development held on 26 March 2024 at ICAR-SBI, Coimbatore.
- Kasthuri Thilagam, V., Vennila, A and Palaniswami, C received best paper award for the paper on "Characterization of waterlogged soil under sugarcane cultivation for their hydraulic properties and nutrient status" in 32nd National Conference on "Soil, Water and Energy Management for Sustainable Agriculture and Livelihood Security" organized by Soil Conservation Society of India, New Delhi at Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, during 18-20 October 2024.
- Krishnapriya, V received the "SSRD Best Research Paper" by Society for Sugarcane Research and Development, Coimbatore on 12 November 2024 for the paper entitled "Genotypic diversity in the type and quantum of root exudates in *Saccharum* complex and allied genera" authored by Krishnapriya, V., Karpagam, E., Arun Kumar, R., Gomathi, R., Chandran, K., Vasantha, S and Alagupalamuthirsolai, M in Journal of Sugarcane Research 12: 172-185.
- Krishnapriya, V received "R. H. Dastur Gold Medal Award 2024" for outstanding contributions in the field of plant physiology & Cognate sciences, conferred by the Indian society for Plant Physiology on 17 December 2024.
- Lakshmi, K received "SSRD Best paper award for the year 2022" for the paper entitled "Cloning and characterization of Patatin like Protein (PLP), a phospholipase gene involved in salinity stress induced lipid signaling" by Kasirajan, L., Keerthana Kamaraj, Sheelamary Sebastiar, Selvi Athiappan, Vivitha Maiyilsamy and Manimekalai Ramaswamy published in Journal of Sugarcane Research, *12*(2), 162-171.
- Malakappa B Medegar received the Certificate of Appreciation under Technical Category for the Year 2024 during the Foundation Day of ICAR-SBI held on 25 October 2024.
- Mahadeva Swamy, H.K received "Best oral presentation" at National Conference on Plant Health for Food Security: Threats and Promises during 1-3 February 2024 at ICAR- Indian Institute of Sugarcane Research, Lucknow for the paper presentation on "Development of association mapping panel and Identification of markers for red rot resistance in sugarcane".
- Mahalakshmi, R received the Certificate of Appreciation under Administrative Category for the Year 2024 during the Foundation Day of ICAR-SBI held on 25 October 2024.
- Malathi, P received "Pushpavathi Blessing Garapati Gold Medal Award" for the best research paper entitled "Mechanized Priming of Sugarcane Planting Materials - An efficient and economical way of delivering agroinputs for Healthy Nursery and Main field crop" during 53 Annual Convention of SISTA" held at Whitefield, Bengaluru during 19-20 August 2024.
- Manimekalai, R received "Sugar Industry Excellence Award – Crop Improvement" from International Association of Professionals in Sugar & Integrated Technologies (IAPSIT) and the

Society for Sugar Research & Promotion (SSRP) during the International Sugarcane conference (Sugarcon 2024) at Vietnam during 16-19, September 2024.

- Meena, M.R received "SSRD Best Paper Award - 2022" for the paper entitled "Genetic variability for fodder quality traits among high biomass energy cane feedstock under rainfed conditions" by Meena, M.R., Govindaraj, P., Rajesh Kumar, Arun Kumar, R., Ravinder Kumar, Chhabra, M.L., Pandey, S.K and Hemaprabha, G. published in Journal of Sugarcane Research 12(1)
- Mohanraj, K et al., received "Best Oral Presentation Award" in the National conference on "Plant Health for Food Security: Threats and Promises", held during 1-3 February 2024 at ICAR-Indian Institute of Sugarcane Research (IISR), Lucknow, Uttar Pradesh.
- Murali, P received SSRP Fellow award (Society for Sugarcane Research and Promotion) for outstanding contribution for sugarcane improvement and diversification during 8th IAPSIT International Sugar Conference 2024 at Vietnam on 21 September 2024.
- Nithya, K received "Best Paper Award – 2021" for the paper entitled "Identification of sugarcane yellow leaf virus resistance in *Saccharum* parental hybrids in India" by Nithya, K., Parameswari, B., Adhini S. Pazhany, Annadurai, A., Nithyanantham, R and Viswanathan, R In: Journal of Sugarcane Research 11(2)
- Pooja received the Certificate of Appreciation under Senior Scientist Category for the Year 2024 during the Foundation Day of ICAR-SBI held on 25 October 2024.
- Prathima, P.T received the NABL Assessor of the year 2024.
- Puthira Prathap, D received the "Tamil Nadu Scientist Award (TANSA)" of Tamil Nadu State Council for Science and Technology, Govt. of Tamil Nadu for the year 2021 from the Hon'ble Minister for Higher Education, Govt of Tamil Nadu, on 23 September 2024.
- Puthira Prathap, D received "Certificate of Appreciation" issued by Registrar, Avinashilingam Institute for Home Science and Higher Education for women, Coimbatore for effective participation in Research Convention – 2024 on 'Holistic approaches to Quality Research', on 23 January 2024.
- Puthira Prathap, D received appreciation from ICAR-KVK, Tiruvannamalai, ICAR-KVK, Tiruppur (30 January 2024) and ICAR-KVK, Villupuram (24 January 2024) and ICAR-KVK, Sivaganga (01 February 2024) for effective co-ordination of *Viksit Bharat Sankalp Yatra* Programme in these districts.
- Puthira Prathap, D received 'Reviewer excellence award' from Agricultural Research Communication Centre, Karnal for serving as reviewer for Agricultural Science Digest journal on 04 November 2024.
- Puthira Prathap, D served as the Chief Editor of *Journal of Extension Education* published by the Extension Education Society during the period under report (2024).
- Puthira Prathap, D served as the Chief Editor of *Journal of Sugarcane Research* published by the Society for Sugarcane Research and Development during the period under report (2024).
- Puthira Prathap, D served as an External member in the meeting organized by the Directorate of Planning and Monitoring, TNAU, to develop a web portal for *Uzhavarin Valarum Velanmai* , the monthly Tamil farm magazine of Tamil Nadu Agricultural University on 19 June 2024.
- Puthira Prathap, D served in the Selection Committee for promotion of the teaching staff from Professor to Senior Professor (Academic level 14 to 15) of Gandhigram Rural Institute (Deemed to be University), Gandhigram on 24 July 2024.
- Puthira Prathap, D served in the Selection Committee for promotion of scientists of Tamil Nadu Agricultural University, Coimbatore under the Career Advancement Scheme in the faculty of Agricultural Extension on 08 July 2024.
- Rajeshkumar, M received the Certificate of Appreciation under Technical Category for the Year 2023 during the Foundation Day of ICAR-SBI held on 29 February 2024.
- Rajula Shanthy, T received "Sugar Industry Excellence Award 2024" for outstanding contribution in rural women empowerment

and entrepreneurship during the 8th IAPSIT International Sugar Conference organized by IAPSIT, China, SSRP, India and STAI, India in Vietnam during 16-19 September 2024.

- Ramesh Sundar, A received the **"Fellow of National Academy of Agricultural Sciences (NAAS)"** in the Foundation Day Programme of the National Academy of Agricultural Sciences (NAAS) held in NASC Complex, New Delhi, during 4-5 June 2024.
- Sankaranarayanan, C received Sir T S Venkataraman Biennial Award for "Outstanding Research in Sugarcane" during the Foundation Day of ICAR-SBI held on 25 October 2024.
- Sankaranarayanan, C received "SSRD Fellow Award" in the AGM Meeting of the Society for Sugarcane Research and Development held on 26 March 2024 at ICAR-SBI, Coimbatore for his meritorious contributions to sugarcane research and development by Society for Sugarcane Research & Development (SSRD), Coimbatore.
- Shanmugam, S received the Certificate of Appreciation under Supporting Staff Category for the Year 2024 during the Foundation Day of ICAR-SBI held on 25 October 2024.
- Shanthi, R.M received "Best paper award" from SSRD in the AGM Meeting of the Society for Sugarcane Research and Development held on 26 March 2024 at ICAR-SBI for the article entitled "Evaluation of full-sib sugarcane families for cane yield potential through Random Coefficient Model (RCM) analysis" authored by Vigneshwari, R., Shanthi, R.M., Pathy, T.L. and Mohanraj, K. 2022 published in Journal of Sugarcane Research, 12(1), pp.32-40.
- Shweta Kumari received "Best Oral Presentation Award" in National conference on Multiomics & Structural Biology in Redefining Therapeutics held on 21 March 2024 at Bharathiar University, Coimbatore.
- Sobhakumari, V.P received "Fellow of Society for Sugarcane Research & Promotion (FSSRP-2024)" at the 8th IAPSIT International Sugar Conference/ Sugarcon 2024-Building a resilient and sustainable global sugar & bio-energy Industry: Transforming ASEAN sugar sector, held from 16-19 September 2024, ICISE, Quy Nhon, Vietnam.
- Subramanyan. S.T received the Certificate of Appreciation under Administrative Category for the Year 2023 during the Foundation Day of ICAR-SBI held on 29 February 2024.
- Subramanian, M received the Certificate of Appreciation under Supporting Staff Category for the Year 2024 during the Foundation Day of ICAR-SBI held on 25 October 2024.
- Suganya, A received "SSRD Fellow Award" in the AGM Meeting of the Society for Sugarcane Research and Development held on 26 March 2024 at ICAR-SBI, Coimbatore.
- Suganya, A has been recognised/empanelled as UPSC adviser/subject expert by UPSC during 2024
- Suganya A, received the Certificate of Appreciation under Principal Scientist Category for the Year 2023 during the Foundation Day of ICAR-SBI held on 29 February 2024.
- Suresha, G.S received the Certificate of Appreciation under Senior Scientist Category for the Year 2023 during the Foundation Day of ICAR-SBI held on 29 February 2024.
- Vinayaka received "Innovative Article Award" on 21 April 2024 for the article entitled 'Rectangular Association and Related PBIB Designs' published in Agriculture & Food: e-Newsletter Magazine (Online), Volume 04 - Issue 11.
- Mementos for successful completion of 30 years in ICAR Service awarded to Dr. P. Govindaraj, Director, Dr. A. Ramesh Sundar, Head, Division of Crop Protection, Dr. A.J. Prabakaran, Principal Scientist., Dr. S. Alarmelu, Principal Scientist., Dr. N. Geetha, Principal Scientist., Dr. T. Rajula Shanthi, Principal Scientist., Dr. V.P. Sobhakumari, Principal Scientist., Dr. C. Palaniswami, Principal Scientist., Dr. K. Hari, Principal Scientist., Dr. A. Selvi, Principal Scientist., Sh. S. Manoharan, Chief Technical Officer., Smt. V. Asha Kumari, Asst. Admin Officer., Sh. Malakappa B Medegar, Senior Technician, Sh. Ramesh Chand, Senior Technician (ICAR-SBIRC, Karnal) and Shri. Vasudev V Galagali, Assistant.

08

Linkages & Collaboration in India Including Externally Funded Projects

The Institute has established linkages with ICAR Institutes like IARI, NBPGR, NRCPB, NBAIR, ISRI, Sugarcane Research Centres of SAUs under AICRP, International Centre for Genetic Engineering and Biotechnology (ICGEB), Ministry of Consumer Affairs, Food and Public Distribution, Ministry of Agriculture-and Farmers Welfare, GoI, Ministry of Food Processing Industries, DST, DBT/GoI, BARC, Directorate of Sugarcane Development, TNPL (a Govt. of Tamil Nadu Undertaking), MSSRF, Chennai and sugar industry in critical areas in emerging technologies for deriving maximum benefit.

Project Title and Scientists involved	Source of Funding	Total Outlay (Rs. In Lakhs)
Identification, characterization and verification of new sugarcane varieties for DUS testing at Coimbatore - S. Alarmelu, R. Karuppaiyan and C. Jayabose	PPV&FRA	5.87
CRISPR–Crop Network–Targeted improvement of stress tolerance, nutritional quality and yield of crops by using genome editing – R. Manimekalai, V.P. Sobhakumari and C. Appunu and M. Ravi, IISER, Trivandrum	NASF	66.10
Improving tillering and yield in sugarcane through creating novel alleles of strigolactone biosynthesis gene MAX4-1 using CRISPR / CAS9 – R. Valarmathi, C. Appunu and K. Mohanraj	DBT	40.00
Deciphering the genetic basis of root-system architecture developing climate resilient sugarcane (BRNS) – R. Valarmathi, C. Appunu, Ashish Kumar Srivastava (Scientific Officer F, BARC)	GoI – DAE – BRNS	25.336
Identification and characterization of SWEET genes associated with sugar content and disease susceptibility in sugarcane – P.T. Prathima	DST-SERB	31.00

Project Title and Scientists involved	Source of Funding	Total Outlay (Rs. In Lakhs)
Targeted genome editing in sugarcane: CRISPR/Cas9-mediated lignin modification towards lignocellulosic biofuel production – K. Lakshmi	DST-SERB	44.53
Development of genome Consortium Databank from plants and microbial population emerging from India – P.T. Prathima	DBT-NNP	26.076
"Genome editing in sugarcane for improve yield, quality, biotic stress tolerance and biomass modification for biofuel production" (under the sub-scheme: Enhancing climate resilience and ensuring food security with genome editing tool) – A. Ramesh Sundar, R. Manimekalai, C. Appunu, K. Lakshmi, G.S. Suresha, P.T. Prathima and R. Valarmathi	EFC	270.53
Agriculture Drone Project (funded by) under Sub Mission on Agricultural Mechanization: Drone Technology Demonstration – T. Arumuganathan and K. Kannan	ICAR-ATARI, Hyderabad	35.00
Identification of salt tolerant sugarcane clones for commercial cultivation in Haryana (RKVY Haryana) – Pooja, Ravinder Kumar, M.R. Meena and M.L. Chhabra	RKVY	242.00
Development and application of diagnostics to viruses and phytoplasmas infecting sugarcane – K. Nithya, D. Neelamathi and R. Selvakumar	ICAR-CRP	75.82
Mechanized priming of planting material and technology popularization for revival of sugarcane productivity in Tamil Nadu (RKVY) – P. Malathi, A. Ramesh Sundar, R. Selvakumar, R. Gopi, T. Rajula Shanthy, A. Vennila, T. Ramasubramanian, Ravindra Naik (CIAE-RS, CBE)	RKVY	27.75
Decoding the molecular events of PAMP-triggered immunity (PTI) by unlocking the interactome of the PAMP-CfEPL1 of *Colletotrichum falcatum* during interaction with sugarcane – A. Ramesh Sundar, V. Jayakumar, G.S. Suresha and P. Malathi	DST-SERB	49.50
Development of onsite field diagnostics to sugarcane grassy shoot disease Candidatus phytoplasma sacchari by RPA-LFD method to ensure healhy seed chain and sustain sugar production – K. Nithya, R. Viswanathan (ICAR-IISR, Lucknow), Susheel Kumar Sharma (ICAR-IARI)	DST-SERB-CRG	61.62
Deciphering susceptibility ("S") genes of engineering red rot resistance in sugarcane through genome editing – A. Ramesh Sundar, A. Jeevalatha and R. Ramesh	AINP on Biotech crops	24.00
Dissemination of technology on mechanized priming of planting material for sustainable sugarcane agriculture P. Malathi, R. Gopi and M.L. Chhabra	NFSM Central	5.00
Impact of climate change on crambid borers of sugarcane and ways of mitigation (DST-SERB-TARE) – T. Ramasubramanian and Sheela Venugopal (TNAU)	DST-SERB-TARE	18.30

Project Title and Scientists involved	Source of Funding	Total Outlay (Rs. In Lakhs)
Artificial intelligence powered diagnostic kit for real-time monitoring of nematode pests of sugarcane - C. Sankaranarayanan (Mentor), D. Suryaprabha (AP, Nehru Arts and Science College, Coimbatore) and N. Seenivasan (TNAU)	DST-SERB-TARE	18.30
Sugarcane based Agri-Business Incubator (ABI) (National Agricultural Innovation Fund Scheme (NAIF) – Component II, IP & TM, ICAR) – P. Murali, K. Hari, G.S. Suresha and D. Puthira Prathap	NAIF	89.50
Intellectual Property Management and Technology Transfer/ Commercialization–Institute Technology Management Unit (ITMU) (National Agricultural Innovation Fund Scheme (NAIF) - ComponentI, IP &TM, ICAR) – K. Hari, Kona Praveen, V. Krishnapriya	NAIF	6.20
Network project "Production systems, Agribusiness and Institutions" NAIP-Component1: Impact assessment of agricultural technology (ICAR-NIAP) – P. Murali, D. Puthira Prathap, K. Hari and Vinayaka	ICAR-NIAP	15.00
Identification, characterization and verification of new sugarcane varieties for DUS testing – M.R. Meena and Ravinder Kumar	PPV&FRA	7.00
ICAR Seed project– Seed production in agricultural crops and fisheries– sugarcane (RFS, Karnal) – Ravinder Kumar and M.R. Meena	ICAR	11.00
Healthy seed production and mechanization of sugarcane agriculture-A farmer's participatory initiative (RKVY-Haryana) – Ravinder Kumar, M.R. Meena, M.L. Chhabra and Pooja	RKVY	87.32
Identification of climate resilient drought tolerant sugarcane varieties suitable for Haryana state – M.R. Meena, Ravinder Kumar, Pooja and M.L. Chhabra	RKVY	198.00
DUS testing of sugarcane (Agali) – R.T. Maruthi and R. Karuppaiyan	PPV&FRA	5.87
Evaluation of nano urea and seaweed extract combination in sugarcane - C. Palaniswami, A. Vennila and V. Kasthuri Thilagam	Bannari Amman Sugars Ltd, Sathyamangalam, Tamil Nadu	16.99
Evaluation of Bannari Bioproducts (Bannari Biozyme, Bannari Biogel, Humic K plus and Bannari Biophosphate) in Sugarcane - C. Palaniswami, A. Vennila, V. Kasthuri Thilagam	Indian Farmers Fertilizers Corporation Ltd, New Delhi	3.47

Project Title and Scientists involved	Source of Funding	Total Outlay (Rs. In Lakhs)
Enhancing Sugar Productivity in Tamil Nadu through Institute-Industry Approach (SISMA-TN funded-SWEET BLOOM 2.0) – Project Members from TNAU, Coimbatore: D. Sassikumar & Satheeshkumar, SRS Cuddalore, V. Anbanandan, SRS Sirugamani, N. A. Saravanan, SRS Melalathur ICAR-SBI, Coimbatore: P. Govindaraj, C. Appunu, R.M. Shanthi, S. Alarmelu, S. Karthigeyan, A. Annadurai, R. Karuppaiyan, K. Mohanraj, R.T. Maruthi, K. Elayaraja, S. Sheelamary, K. Gopalareddy, H.K. Mahadeva Swamy, R. Gobu, Adhini S Pazhany, Kona Praveen, T. Lakshmi Pathy, D. Neelamathi, C. Jayabose, R. Valarmathi, B. Singaravelu, P. Malathi, R. Selvakumar, T. Ramasubramanian, M. Punithavalli, P. Mahesh	SISMA	53.00
Identification of suitable location specific sugarcane varieties for commercial cultivation under different agro-climatic situations in India – P. Govindaraj ICAR-SBI, Coimbatore: K. Mohanraj, R.M. Shanthi, S. Alarmelu, A. Anna Durai, S. Karthigeyan, R. Karuppaiyan, C. Appunu, R.T. Maruthi, S. Sheelamary, K. Elayaraja, Adhini S. Pazhany, K. Gopalareddy, H.K. Mahadeva Swamy, R. Gobu, Kona Praveen, T. Lakshmi Pathy, D. Neelamathi and A. Ramesh Sundar ICAR-SBIRC, Karnal: Ravinder Kumar, M.R. Meena and M.L. Chhabra; ICAR SBIRC, Kannur: M. Nisha	ISMA	750.00
Improving water use efficiency and economizing water use in sugarcane cultivation in sub-tropical India ICAR-SBI, Coimbatore: P. Geetha, S. Anusha ICAR-SBIRC, Karnal: Pooja, Ravinder Kumar	ISMA	12.87
FNS Commercial Crops 2024-25 (Cotton & Sugarcane) – State – D. Neelamathi	NFSM-State	3.5
Development of Action Plan for Scheduled Caste (DAPSC) – A. Anna Durai, R. Arun Kumar and P. T. Prathima	ICAR	215.50
North Eastern Region (NEH) component of ICAR – A. Anna Durai, R. Karuppaiyan, K. Mohanraj and R.Gopi	ICAR	0.0
Development of Action Plan for Scheduled Tribe Component (DAPSTC) – D. Puthira Prathap, K. Mohanraj, R. Gopi, P. Geetha and V. Sreenivasa	ICAR	50.0
Evaluation of biofertilizer and bio stimulant combination in sugarcane - M. Alagupalamuthirsolai and K. Hari	BOMLIFE Pvt. Ltd., Kolkatta	15.78

International cooperation

Dr. N. Geetha was deputed as an expert to Sugar Research Institute of Fiji (SRIF) in Crop Protection – Entomologist and pathologist under ITEC programme of Ministry of External Affairs, India for a period of two years from 28 November 2022 to 26 November 2024.

09

All India Co-ordinated Research Project on Sugarcane - AICRP (S)

The All India Coordinated Research Project on Sugarcane was started in 1971. A National Hybridization Garden was established in the Institute to facilitate the national breeding programmes. The following are the research areas under this project:

Fluff supply to various sugarcane research institutes / centres.

Evaluation of 'Co' canes for different sugarcane growing regions and acting as the coordinating unit for the identification of 'Co' and other Co- regional selections.

To gather information on general and specific combining ability of biparental crosses.

Collaboration for development of national varieties.

Collaborative research on Agronomy, Soil science, Plant Physiology, Entomology and Plant Pathology.

Dr. P. Govindaraj, Director is the Principal Investigator of Crop Improvement

10

Publications

Research Papers

Alagupalamuthirsolai, M., Murugan. M., Ashokkumar, K., Ankegowda, S.J., Vellaikumar, S., Srinivasan, V., Honnappa Asangi, Akshitha, H.J., Mohammed Faisal Peeran, Sivaranjani, R. and Arun Kumar, R. 2024. Bio-active essential oil components in small cardamom as influenced by weather elements. *AMA, Agricultural Mechanization in Asia, Africa and Latin America* 55(04):17549–60.

Alagupalamuthirsolai, M., Renuka Suresh, Srinivasan, V., Thankamani, C.K. and Gobu, R. 2024. Effects of chemicals on water stress alleviation in black pepper (*Piper nigrum* L.) rooted cuttings. *Ecology, Environment and Conservation* 30(1):398–402.

Amaresh, G., Nunavath, A., Appunu, C., Viswanathan, C., Rajeev Kumar, Gujjar, R.S. and Manimekalai, R. 2024. Advanced genome editing technologies: potentials and prospects in improvement of sugar crops. *Sugar Tech* (2024). https://doi.org/10.1007/s12355-024-01447-4

Ameer, A.A., Thirugnanasambandam, P.P., Vannish, M.R. and Basheer, S. 2022. SWEET transporters in plants and their significance in Sugarcane. *Journal of Sugarcane Research* 12(2):112-127.

Anna Durai, A., Amaresh, Arun Kumar, R., and Hemaprabha, G. 2024. Elucidating the GxE interaction using AMMI, AMMI stability parameters and GGE for cane yield and quality in sugarcane. *Tropical plant biology* 18 (1), 3.

Anusha, S., Geetha, P., Krishnapriya, V., Tayade, A.S. and Arun Kumar, R. 2024. Management of diverse weed flora in widely spaced sugarcane plant crop in tropical India through sequential and tank mix application of herbicides. *Sugar Tech* https://doi.org/10.1007/s12355-024-01515-9

Appunu, C., Hemaprabha, G., Sreenivasa, V., Anna Durai, A., Mohanraj, K., Elayaraja, K., Sheelamary, S., Vinu V., Pazhany, A.S., Mahadeva Swamy, H.K., Lakshmi Pathy, T., Karuppaiyan, R., Karthigeyan, S., Govindaraj, P., Alarmelu, S., Shanthi, R.M., Prabakaran, A.J., Ananda Lekshmi, Surya Krishna, S., Arun Kumar, R., Karjagi, C.G. and Ram, B. 2024. Evaluation of sugarcane genotypes (*Saccharum sp.* hybrid) for multi-trait stability analysis across diverse environments. *Industrial Crops and Products* 219:118993 https://doi.org/10.1016/j.indcrop.2024.118993

Appunu, C., Krishna, S.S., Chandar, S.H., Valarmathi, R., Suresha, G.S., Sreenivasa, V., Malarvizhi,

A., Manickavasagam, M., Arun, M., Kumar, R.A. and Gomathi, R. 2024. Overexpression of EaALDH7, an aldehyde dehydrogenase gene from *Erianthus arundinaceus* enhances salinity tolerance in transgenic sugarcane (*Saccha*rum spp. Hybrid). *Plant Science* 348:112206.

Appunu, C., Surya Krishna, S., Mahadevaiah, C., Valarmathi, R., Suresha, G.S., Swathik Clarancia, P., Ravinder Kumar., Arun Kumar, R., Pooja Dhansu., Meena, M.R., Gomathi, R., Boominathan, P., Manickavasagam Markandan and Arun Muthukrishnan. 2024. Overexpression of an NF-YB gene family member, EaNF-YB2, enhances drought tolerance in sugarcane (Saccharum spp. Hybrid). *BMC Plant Biology.* p.1246. https://doi.org/10.1186/s12870-024-05932-624

Ariharasutharsan, G., Pooja Negi, Vinoth, P., Malarvizhi, A., Senthilrajan, P., Appunu, C., Ashish, K. Srivastava, and Valarmathi, R. 2025. Gamma ray induced significant phenotypic and metabolite changes in sugarcane variants derived through *in-vitro* mutagenesis. *Applied Radiation and Isotopes* 217.111597.

Aswini, N., Amaresh, M., Nandhini, S., Keerthana, Rajeev Kumar, Gujjar, R.S., Gomathi, R., Selvi, A., Govindaraj, P. and Manimekalai, R. 2024. Genome-wide expression profiling of cytochrome p450 genes in response to the oxidative stress in Saccharum spp. *Sugar Tech.* DOI: 10.1007/s12355-024- 01509-7.

Dinesh, R., Sreena, C.P., Sheeja, T.E., Srinivasan, V., Subila, K.P., Charles Sona, I.P., Vijesh Kumar, Anusree, M., Alagupalamuthirsolai, M., Jayarajan, M. and Sajith. V. 2024. Co-resistance is the dominant mechanism of co-selection and dissemination of antibiotic resistome in nano zinc oxide polluted soil. *Journal of Hazardous Materials* 485:136885.

Girija Sangari Murugavelu, Harish Chandar, S.R., Surya Krishna Sakthivel, Manimekalai Ramaswamy, Amutha Swaminathan, Appunu Chinnaswamy. 2024. Progress and Updates of CRISPR/Cas9-Mediated Genome Editing on Abiotic Stress Tolerance in Agriculture: A Review. *Sugar Tech* 1-15, https://doi.org/10.1007/s12355-024-01448-3

Gomathi, R., Kohila S., Viswanathan, R., Krishnapriya, V., Appunu, C., Arun Kumar, R., Alagupalamuthirsolai, M., Manimekalai, R., Elayaraja, K. and Kaverinathan, K. 2024. Comparative proteomic analysis of high-temperature response in sugarcane. *Sugar Tech.* https://doi.org/10.1007/s12355-024-01400-5

Gopi, R., Chandran, K., Ramesh Sundar, A., Viswanathan, R., Jayakumar, V., Mahendran, B., Sony Jayaraman. and Gireesan P.P. 2024. Thirty-two years of smut disease status in the world's largest sugarcane germplasm. *Indian Phytopathology* 77:51-59. https://doi.org/10.1007/s42360-023-00700-2

Gopi, R., Viswanathan, R., Chandran, K., Sony Jayaraman, Mahendran, B. and Nisha, M. 2024. Molecular identification of sugarcane stalk rot pathogen (*Phaeocytostroma sacchari*). *Journal of Sugarcane Research 12*(2):140-145. https://doi.org/10.37580/JSR.2022.2.12.140-145r

Harish Chandar, S.R., Mahalakshmi, S., Surya Krishna, S., Swathi, T., Girija Sangari, M., Viswanathan, C., Saranya, N., Sobhakumari,V.P., Gomathi, R. and Appunu, C. 2024. Isolation, characterization and genome-wide identification of Cys-2/His-2 type zinc finger nuclease, a transcription activator in *Saccharum* complex under abiotic stress conditions. *Sugar Tech.* https://doi.org/10.1007/s12355-024-01397-x

Jayabose, C., Anusheela, V., Hemadarshini, M., Valarmathi, R., Neelamathi, D., Prabakaran, M. and Prithika, P. 2024. Study on regeneration ability of *Saccharum* sp clones for optimizing cryopreservation techniques and identification of suitable explant for long-term storage. *Sugar Tech* 26:396–407. https://doi.org/10.1007/s12355-024-01362-8

Jitendra K.C., Kausik, P., Rajula Shanthy, T., Vinod Kumar, Ashok Kumar Sharma et al. 2024. Unveiling the intellectual landscape of indian research journal of extension education (IRJEE): A bibliometric content analysis. *Indian Research Journal of Extension Education* 24(3):1-18. doi:10.54986/irjee/2024/jul_sep/1-18.

Kasirajan, L., Keerthana Kamaraj, Sheelamary Sebastiar, Selvi Athiappan, Vivitha Maiyilsamy, and Manimekalai Ramaswamy. 2024. Cloning and characterization of Patatin like Protein (PLP), a phospholipase gene involved in salinity stress induced lipid signaling. *Journal of Sugarcane Research* 12(2):162-171. https://doi.org/10.37580/JSR.2022.2.12.162-171

Kasthuri Thilagam,V., Manivannan, S. and Srinivasan, R. 2024. Morphological characterization of an agricultural watershed using geospatial tools for effective planning of engineering structures. *Climate Change and Environmental Sustainability* 11(1):49-56. DOI: 10.5958/2320-642X.2023.00006

Khumla, N., Solomon, S., Manimekalai, R. and Misra, V. 2024. Prospects of diversification for sustainable sugar bioenergy industries in ASEAN Countries. *Sugar Tech*. https://doi.org/10.1007/s12355-024-01432-x

Krishnapriya, V., Karpagam, E., Arun Kumar, R., Gomathi, R., Chandran, K., Vasantha, S. and Alagupalamuthirsolai, M. 2022. Genotypic diversity in the type and quantum of root exudates in *Saccharum* complex and allied genera. *Journal of Sugarcane Research* 12:172-185. https://doi.org/10.37580/JSR.2022.2.12.172-185

Krishnapriya, V., Karpagam, E., Vasantha, S., Arun Kumar, R., Anusha, S., Vinu V., Alagupalamuthirsolai, M. and Gomathi R. 2024. Deficiency, critical threshold, and sufficiency levels for hydroponic supplementation of major nutrients for evaluating sugarcane under controlled conditions. *Journal of Soil Science and Plant Nutrition*. https://doi.org/10.1007/s42729-023-01604-w

Krithika, V.P., Anita Bellie, Ganeshan Shandeep, Vijay Settu, Deeikshana Thirunavukkarasu, Haran Ramkumar, Sankaranarayanan, C., Prabhu Somasundaram, and Devrajan, K. 2024. Genome mining of *Photorhabdus luminescens* TNAU1 reveals novel gene assets with insecticidal and nematicidal properties. *Physiological and Molecular Plant Pathology* 133:102358. https://doi.org/10.1016/j.pmpp.2024.102358

Krithika, V.P., Anita Bellie, Ramkumar Haran, Deeikshana Thirunavukarasu, Shandeep Ganeshan, Sankaranarayanan, C., Prabhu Somasundaram, Suganthy, M. and Gomathi. 2024. Nanoemulsified formulation of cell-free supernatant from *Photorhabdus luminescens* as a sustainable biopesticide against Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae). *Crop Protection*. https://doi.org/10.1016/j. cropro.2024.107057

Kumar, R., Meena, M., Dhansu, P., Chhabra, M.L., Appunu, C., Sreenivassa, V., Durai, A.A., Swamy, H.K.M. and Amaresh. 2024. Disclosure of Productive and Stable Sugarcane Genotypes for Cane Yield and Quality Traits Using Various Stability Statistics. *Tropical Plant Biology*. 18, 11 https://doi.org/10.1007/s12042-024-09374-0

Madhu, M., Kannan, K., Singh D.V. and Gopal Kumar. 2024. Agronomic solutions for reducing soil erosion and achieving land degradation neutrality. *Indian Journal of Agronomy* 69 (Global Soils Conference Special issue): S66-S80 (2024).

Mahendiran, K., Muthuramalingam, R., Prathap, D Puthira, Velusamy, R., Senthilnathan, S., Karuppiah, P., Ramesh, R., Radhakrishnan, Anuratha, Venkatesan, P., Jegadeesan. M., Subash, S. and Shanmugasundaram, B. 2024. Farmer's intention to spend on green farming technologies: exploring the determinants through structural equation modelling approach. *Fresenius environmental bulletin* 33(11-12):1283-1296.

Mahendran, B., Gopi, R., Mahesh, P., Chandran, K, and Nisha, M. 2024. Field dynamics of entomopathogenic fungi attacking sugarcane planthopper, *Pyrilla perpusilla* (Lophopidae: Hemiptera) in a managed agro-ecosystem comprising sugarcane germplasm. *Sugar Tech*. https://doi.org/10.1007/s12355-024-01410-3

Mahesh, P., Singaravelu, B., Srikanth, J., Salin, K.P., Chandran, K., and Nirmala, R. 2024. Resistance of sugarcane hybrids to internode borer *Chilo sacchariphagus indicus* (Lepidoptera: Crambidae). *Experimental Agriculture*. https://doi.org/10.1017/S0014479724000024

Mahesh, P., Srikanth, J., Appunu, C., Singaravelu, B., Puthira Prathap, D., Alfred Danie, J., Mahendran, B., Mohanraj, K., Gopi, R. and Nirmala, R. 2024. Spotted stem borer *Chilo partellus*: Occurrence, biology and relative resistance in *Erianthus arundinaceus*. *Sugar Tech*. https://doi.org/10.1007/s12355-024-01516-8

Mall, A.K., Manimekalai, R., Misra, V., Pandey, H., Srivastava, S. and Sharma, A. 2024. CRISPR/Cas mediated genome editing for sugarcane improvement. *Sugar Tech*, 1-13. https://doi.org/10.1007/s12355-023-01352.

Manikantan M.R., Pandiselvam R., Arumuganathan, T., Anandu Chandra Khanashyam, and Varadharaju, S. 2022. Biochemical, colour and sensory attributes of pasteurized sugarcane juice stored in high-density polyethylene-based nanocomposite

films. *Packaging Technology and Science*. DOI: 10.1002/pts.2647.

Manimekalai, R., Saranya, J., Saravanakumar, K., Rajagopal, S., Jini, N., Selvi, A., Rabisa, V.P., Nandhini, M., Vannish, R., Thirugnanasambandam, P.P. and Gomathi, R. 2024. Small RNA profiling and co-networking analysis identifies stress-responsive miRNAs involved in sugarcane and its wild species. *Plant Physiology Reports:* pp.1-19.

Manivannan, S., Kasthuri Thilagam, V., Ravindra Yaligar and Manoj, K.N. 2024. Crop planning using innovative trend analysis of 62-years rainfall data. *Indian Journal of Agricultural Sciences* 94 (7):774-779. https://doi.org/10.56093/ijas.v94i7.145980

Manoj Vadakkenchery Mohanan, Sarath Padmanabhan Thelakat Sasikumar, Ashwin Narayan Jayanarayanan, Dharshini Selvarajan, Valarmathi Ramanathan, Suresha Giriyapura Shivalingamurthy, Gomathi Raju, Hemaprabha Govind and Appunu Chinnaswamy. 2024. Transgenic sugarcane overexpressing glyoxalase III improved germination and biomass production at formative stage under salinity and water-deficit stress conditions. *3 Biotech* 14(2):52. https://doi.org/10.1007/s13205-023-03856-w

Meena, M. R. Govindaraj, P. , Raja Arun Kumar, K. Elayaraja, C. Appunu, Ravinder Kumar, M. L. Chhabra, Neeraj Kulshreshtha and G. Hemaprabha (2024). Biomass and energy potential of *Erianthus arundinaceus* and *Saccharum spontaneum*-derived novel sugarcane hybrids in rainfed environments. BMC Plant Biology 24, 198 (2024). https://doi.org/10.1186/s12870-024-04885-0

Meena, M.R., Kumar, R., Karuppaiyan, R. N. Kulshreshtha, M L Chhabra, P. Govindaraj and G. Hemaprabha (2024). Unraveling the Stability of Sugarcane Clones Using Multivariate Stability Models for Cane Yield and Quality under Subtropical Climates. *Sugar Tech.* 26, 1790–1801. https://doi.org/10.1007/s12355-024-01442-9

Meena, M.R., Alarmelu, S., Vasantha, S., Sheelamary, V., Anusheela, R., Arun Kumar, Ravinder Kumar, M.L., Chhabra, S., Mutharasu, and Karthick, M. 2024. Drought resilience evaluation of sugarcane (*Saccharum* spp.) hybrids in Indian tropical and sub-tropical climates. Indian Journal of Genetics and Plant *Breeding* 84(2):266-272.

Meena, M.R., Mohanraj, K., Kumar, R., Kumar, R.A., Chhabra, M.L., Kulshreshtha, N.,Krishnappa, G., Swamy, H.K.M., Suganya, A., Govindaraj, P. *et al*. 2024. Deciphering winter sprouting potential of *Erianthus procerus* derived sugarcane hybrids under subtropical climates. *Plants 13, 1023. https://doi.org/10.3390/plants13071023*

Mohanan, M.V., Thelakat Sasikumar, S.P., Jayanarayanan, A.N., Selvarajan, D., Ramanathan, V., Shivalingamurthy, S.G., Raju, G., Govind, H. and Chinnaswamy, A. 2024. Transgenic sugarcane overexpressing Glyoxalase III improved germination and biomass production at formative stage under salinity and water-deficit stress conditions. *3 Biotech* 14(2):1-1.

Nalayeni Kumaravel, Leonard Barnabas Ebinezer, N.M.R. Ashwin, Cinzia Franchin, Ilaria Battisti, Paolo Carletti, Amalraj Ramesh Sundar, Antonio Masi, Palaniyandi Malathi, Rasappa Viswanathan, Giorgio Arrigoni.2024. Comparative proteomics of sugarcane smut fungus - *Sporisorium scitamineum* unravels dynamic proteomic alterations during the dimorphic transition. *Journal of Proteomics*, 105230, ISSN 1874-3919, https://doi.org/10.1016/j.jprot.2024.105230

Nehatai, A.W., Varghese, C., Vinayaka, Mohd, H. and Devendra, K. 2024. On construction of doubly nested partially balanced incomplete block designs. *Bhartiya Krishi Anusandhan Patrika* 39(2):101-107. DOI: 10.18805/BKAP702.

Niranjan, S., Murali, P., Prathap, D. Puthira, Kumaravel, S., and Hemaprabha, G. 2024. Impact of wonder cane varieties on sugar production, consumption and prices in India. *Sugar Tech* 26(3):809-819.

Pathy, T.L., Rao, A.M., Krishna, T.V., Tripathi, K., Ramesh, S., Rahul, N.A., Bhat, A.G. and Honnannavar, P.B. 2024. Characterising cowpea (*Vigna unguiculata* L. Walp) mini-core set for flowering responses to various photoperiod and temperature regimes. *Genetic Resources and Crop Evolution*, 1-21.

Pathy, T.L., Rao, A.M., Ramesh, S., Madhusudan, K., Nagaraju, N., Anand, S., Rahul, N.A., Prashantha, V. and Jain, J.A. 2024. Identifying promising cowpea (*Vigna unguiculata* L. Walp) genotypes for grain yield and its component traits through direct and indirect selection suitable for rabi conditions. *Mysore Journal of Agricultural Sciences* 58(4):89-99.

Poovai, P.D., Athmaselvi, K.A., Arumuganathan, T., Shubham Subrot Panigrahi, C., Indu Rani, and Neelavathi, R. 2023. Effects of tray and freeze drying on physico-chemical and structural properties of fig fruit powder. *Journal of Agricultural Engineering (India)* 60(3):251-260. https://doi.org/10.52151/jae2023603.1811.

Praveen Kona, Ajay B.C., Gangadhara K., Narendra Kumar, Raja Ram Choudhary, M.K. Mahatma, Sushmita Singh, Kiran K. Reddy, Bera S.K, Chandramohan Sangh., Kirti Rani, Zarana Chavada, and Solanki K.D. 2024. AMMI and GGE Biplot Analysis of Genotype by Environment Interaction for Yield and Yield contributing traits in Confectionery Groundnut. *Scientific reports* 4:2943.

Preet K, Dhansu P, Sehrawat N, Kumar R, C. Appunu, Krishnapriya V, Raja A, Rana R, Kumar S, Joon V. 2024. Morpho-physiological analysis of salinity tolerance in sugarcane genotypes. Plant Physiology Reports 29, 356–366. https://doi.org/10.1007/s40502-024-00782-8

Punithavalli, M., Mohanraj, K., Rajula Shanthi, T. and Yuvan Sankar Pandian, M. 2024. Mechanism of biochemical resistance in sugarcane varieties derived from *Saccharum* and *Erianthus* against borer pests. *Sugar Tech*. https://doi.org/10.1007/s12355-024-01521-x

Raja, P., Sona, F., Surendran, U., Srinivas, C.V., Kannan, K., Madhu, M., Mahesh, P., Annepu, S.K., Ahmed, M., Chandrasekar, K. and Suguna, A.R., 2024. Performance evaluation of different empirical models for reference evapotranspiration estimation over Udhagamandalm, The Nilgiris, India. *Scientific Reports* 14(1):12429.

Ramappa, D., Kavan Kumar, V., Mohith Kumar, G.V., Kumargouda, V., Sachin, C., Hallad, T.N., Aruna, Y., Ravi, Murali, P. 2024. Standardization of vacuum frying techniques for the development of low-fat beetroot finger chips. *Food and Humanity*, Volume 3, 2024, 100424. ISSN 2949-8244, https://doi.org/10.1016/j.foohum.2024.100424

Ramasubramanian, T. 2024. Persistence and dissipation kinetics of flubendiamide in the tropical sugarcane ecosystem. *Journal of Crop Health* 76:1643–1651.

Ramasubramanian, T., Yogambal, C. and Singaravelu, B. 2024. Bio□ecology of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) in Sugarcane. *Sugar Tech*. https://doi.org/10.1007/s12355-024-01487-w.

Rani, K., Gangadhara K., Ajay B. C., Praveen Kona, Narendra Kumar and Bera S. K. 2024. A comprehensive phenotypic and genotypic evaluation of Spanish groundnuts from diverse crosses to identify superior and stable donors for fresh seed dormancy. *Scientific reports* 14:14988.

Rani, L., Gangadhara K., Ajay B. C., Praveen Kona, Sushmita Singh, Narendra Kumar and Bera S. K. 2024. Multi-phenotyping and genotyping of Spanish groundnuts from diverse crosses to identify sources of fresh seed dormancy and selection of high yielding stable genotypes. *Indian Jounal of Genetics and Plant Breeding*. 84(2): 242-249.

Rani, K., Ajay, B.C., Bera, S.K., Mahesh Kumar Mahatma, Sushmita Singh, K. Gangadhara, A. L. Rathnakumar, Praveen Kona, Narendra Kumar and G. A. Rajanna. 2024. Genetic exploration of variability and environmental influence on yield, components, and nutritional properties among groundnut germplasm originated from different countries for identification of potential stable donors. *Genet Resour Crop Evol* 71, 2077–2090.

Saljuna, K.P., Thankamani, C.K., Alagupalamuthirsolai, M., Krishnamurthy, K.S. and Gayathri Pavithran. 2024. Effect of plant growth regulators on nutrient and quality changes in *Zingiber officinale* Rosc. *Journal of Scientific Research and Reports* 30(4):36–44.

Singh, S., Sangh, C., Kona, P. and Bera S.K. 2024. Genome editing in peanuts: advancements, challenges and applications. *Nucleus* 67, 127–139.

Saranya, R., Malathi, P., Nithyanantham, R., Ritu Mawar and Viswanathan, R. 2024. Evaluation of biofumigation strategy for the management of *Colletotrichum falcatum* Went- red rot disease of sugarcane. *Sugar Tech*. DOI: 10.1007/s12355-024-01369-1

Sarathambal, C., Srinivasan, V., Jeevalatha, A., Sivaranjani, R., Alagupalamuthirsolai M., Peeran, M.F., Mukesh Sankar, S., George, P., and Dilkush,F. 2024. Unravelling the synergistic effects of arbuscular mycorrhizal fungi and vermicompost on improving plant growth, nutrient absorption, and secondary metabolite production in ginger (*Zingiber officinale* Rosc.). *Frontiers in Sustainable Food Systems* 8:1412610.

Senthilkumar, S., Kuppusamy, S., Palai, S., Rajanbabu, V., and Vennila A., 2024. Exploring Sargassum extract as a Bio–stimulant: Advancements and benefits in Soil–Plant Systems – a Review. *Communications in Soil Science and Plant Analysis* 1–11. https://doi.org/10.1080/00103624.2024.2397013

Sobhakumari, V.P. and Mohanraj, K. 2024. Application of genomic *in situ* hybridization (GISH) and tandem repeat sequence amplification for identification of *Erianthus – Saccharum* introgression. *Caryologia* 77(2):49-55. https://doi.org/10.36253/caryologia-2670

Sobhakumari, V.P. and Mohanraj, K. 2024. Genomic *in situ* hybridization (GISH) and performance analysis in intergeneric hybrids from five consecutive generations of *Erianthus x Saccharum*. *Caryologia 77(3):27-36. https://doi.org/10.36253/caryologia*

Solomon, S., Rao, G.P., Vanichsriratana, W., Manimekalai, R., Priyanka Singh, C.A., and Duong, C.A. 2024. Silver Jubilee Special Issue: Sustainability through Diversification in the Sugar Industry. *Sugar Tech* 25: 921–925.

Sreenivasa, V., Mahadevaiah, C., Amaresh, Ravinder Kumar, Arun Kumar, R., Mintu Ram Meena, Anna Durai, A., Appunu, C., Hemaprabha, G. and Govindaraj, P. 2024. Evaluation of *Saccharum* and *Erianthus* introgressed early generation novel sugarcane hybrids as potential sources of biomass for cogeneration. *Sugar Tech*. https://doi.org/10.1007/s12355-024-01421-0

Sreenivasa, V., Mahadevaiah, C., Mahadeva Swamy H.K., Arun Kumar, R., Mintu Ram Meena, Appunu, C., Ravinder Kumar, Mohanraj, K., Govindaraj, P. and Hemaprabha, G. 2024. Deciphering biomass contributing traits of interspecific and intergeneric hybrids derived from early generations hybrids of *Saccharum and Erianthus* spp. as potential sources of biomass and bioenergy. *Industrial Crops and Products*, 211,2024,118267,ISSN 0926-6690, https://doi.org/10.1016/j.indcrop.2024.118267

Sudhagar, R., Saravanan, N.A., Kanchanarani, R., Shanmuganathan, M., Ganapathy, S., Babu, C., Thirumurugan, A., Ravichandran, V., Appunu, C. and Anna Durai, A. 2024. Evolution, identification, evaluation, and characterization of a stable salinity tolerant sugarcane variety CoG 7. *Scientific Reports* 14, 20448 (2024). https://doi.org/10.1038/s41598-024-70756-1

Sudheer Kumar Annepu, Raja Pushpanathan, Rajan Karuppasamy, Sundarambal Palanisamy, Kannan Kurathalvar, Vanitha, S.M., Anupam Barh, Mahantesh Shirur and Poonam Khatri. 2024. Improving soil resilience and crop productivity through recycling of spent mushroom substrate: a transition towards circular economy in hill agriculture. *Clean – Soil, Air, Water*, 2024; 0:e202400050, https://doi.org/10.1002/clen.202400050

Suganya, A., Govindaraj, P., Selvi, A. and Viswanathan, R. 2023. Red rot resistance in interspecific hybrids of sugarcane derived from diverse cytotypes of *Saccharum spontaneum* L. (wild relative of sugarcane). *Journal of Sugarcane research* 13(1)

Venkatesh, Y.N., Ashajyothi, M., Rajarajan, K., Sahu, S., Chaturvedi, V., Thirugnanasambandam, P.P., Muthamilarasn, M., Handa, A.K. and Arunachalam, A., 2024. Transcriptional and physio-chemical responses of *Tectona grandis* L. triggered by teak defoliator. *Plant Stress* 12:100468.

Vignesh, P., Mahadevaiah, C., Selvamuthu, K., Mahadeva Swamy, H.K., Sreenivasa, V. and Appunu, C. 2024. Comparative genome-wide characterization of salt responsive micro RNA and their targets through integrated small RNA and de novo transcriptome profiling in sugarcane and its wild relative *Erianthus arundinaceus*. *3 Biotech* 14(1):24. https://doi.org/10.1007/s13205-023-03867-7

Vigneshwari, R., Shanthi, M., Lakshmi Pathy, T., and Mohanraj, K. 2024. Estimates of genetic parameters and prediction of breeding values among full-sib sugarcane families for commercial cane sugar yield traits through reml/blup analysis. *Sugar Tech* https://doi.org/10.1007/s12355-024-01480-3

Vinayaka and Prasad, P.R.C. 2024. AI-Enhanced remote sensing applications in Indian sugarcane research: A comprehensive review. *Sugar Tech* 26:609–628. https://doi.org/10.1007/s12355-024-01409-w.

Vinayaka, Mandal, B.N., Parsad, R., Vinaykumar, L.N., Murali, P., Amaresh, and Kumari, S. 2024. Incomplete block designs for comparing test treatments with multiple controls. *Bhartiya Krishi Anusandhan Patrika* 39(2):108-114. DOI: 10.18805/BKAP723

Vinayaka, Parsad, R. and Mandal, B.N. 2024. Partially balanced nested block designs based on

2-associate-class association schemes for test-control comparisons. *Communications in Statistics - Simulation and Computation*. https://doi.org/10.1080/03610918.2024.2317872

Vinu V., Pathy, T.L., Mahadeva Swamy H. K., Valarmathi, R., Manju M. Paul and Kumar, R.A. 2024. Evaluation of *Saccharum spontaneum* clones for water deficit stress tolerance. *Indian Journal of Plant Genetic Resources* 37(1):73-79. DOI: 10.61949/0976-1926. 2024.v37i01.09

Vinu, V., Alarmelu, S., Elayaraja, K., Appunu, C., Hemaprabha, G., Parthiban, S., Shanmugasundaram, K., Rajamadhan, R., Saravanan, K.G., Kathiravan, S., Ram, B., Vinayaka, V. and Varatharaj, M.K.C. 2024. Multi-environment analysis of yield and quality traits in sugarcane (*Saccharum* sp.) through AMMI and GGE biplot analysis. *Sugar Tech*, 1-19. https://doi.org/10.1007/s12355-024-01498-7

Viswanathan, R., Selvakumar, R., Malathi, P. et al. 2024. Impact of wilt on flowering and ratoon establishment in parental clones of sugarcane. *Sugar Tech*. https://doi.org/10.1007/s12355-024-01526-6

Books/Compendia/Training manuals

Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. 2024. Value addition and product diversification in sugarcane. Springer Nature, Singapore. pp. 362. ISBN 978-981-97-7227-8.

Venkatasubramanian, V., Murali, P., Puthira Pradhap, D., Arumuganathan, T., Hari K. and Bakshi Ram. 2024. Agri-preneurship. ICAR-Sugarcane Breeding Institute, Coimbatore and ICAR - Agricultural Technology Application Research Institute, Bengaluru. pp. 266. (ISBN: 978-93-85267-25-3).

Chapters in Books/ Training manuals

Alarmelu, S. 2024. Introgression, backcrossing and gene pyramiding. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 143-159. ISBN 978-93-85267-42-0

Amaresh., Nunavath, A., Vinayaka., Kumari, S., Avinash, G., Abhishek, G.J., Dhanya, V.G., Maruthi, R.T., Krishnappa, G., Swamy, H.K. and Suresha, G.S. 2024. Sugarcane Bagasse: transforming waste into renewable and bio-compostable materials for a sustainable future. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 239-256. https://doi.org/10.1007/978-981-97-7228-5_12

Arun Kumar, R., Hemaprabha, G., Anusha, S., Krishnapriya, V., Sreenivasa, V., Vinu, V., Vasantha, S., Tayade, A.S., Alagupalamuthirsolai, M., Pooja, D., Gomathi, R., Hari, K., Appunu, C. and Palaniswami, C. 2024. Physiological Basis of water productivity, nutrient use efficiency and radiation use efficiency in sugarcane clones. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 260-274. ISBN: 978-93-85267-42-0

Balakumaran, M., Gobu, R., Berliner, J., Sellaperumal, C. 2024. Transcriptomic Resources of Cardamom and Their Implications. In: The Cardamom Genome. Compendium of Plant Genomes. Sabu, K.K. and Kole, C. (Eds). pp. 89-98. Springer, Cham.

Chand G, Dogra S, Kumar A, Dhansu P, and Mann A. (2024). Exploring ecophysiological constraints in halophytes and innovative strategies for advancing biosaline agriculture. In: Halophytes vis-à-vis Saline Agriculture: Perspectives and Opportunities for Food Security, pp. 231-262. Singapore: Springer Nature Singapore.

Chandran, K., Nisha, M., Gopi, R., Mahendran, B., Keerthi, S.C., Dilsha, C., Suresha, G.S., Hari, K. and Hemaprabha, G. 2024. Sugarcane-based traditional sweeteners and health benefits. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 269-293. https://doi.org/10.1007/978-981-97-7228-5_1

Dasmandal, T., Kumari, S., Sahu, T.K., Balakrishnan, M., Supriya, P. and Mangrauthia, S.K. 2024. Intervention of bioinformatics and computational biology in climate-resilient agriculture. In: Research and Technological Advances for

Resilient Agriculture. Srinivasa Rao, Ch., Vijay Avinashilingam, N.A., and Yashavanth, B.S. (Eds). ICAR-National Academy of Agricultural Research Management, Hyderabad, India. pp. 155- 178.

Dhansu P, Yadav S, Preet K, Devi S, Kumar R, Kumar A, Pazhani AS, Pandey S. K. (2024). Sugarcane: An overview of physiological and biochemical studies under drought and salt stress. In: Sugarcane Cultivation and Management: Challenges and Opportunities, pp. 324, Apple Academic Press. Gomathi, R., Kohila, S. and Arun Kumar, R. 2024. Impact of temperature extremes on sugarcane growth and development. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 296-309. ISBN: 978-93-85267-42-0

Gomathi, R., Kohila, S. and Arun Kumar, R. 2024. Impact of temperature extremes on sugarcane growth and development. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 296-309. ISBN: 978-93-85267-42-0

Gomathi, R., Rakkiyappan, P., Tayade, A.S., Arumuganthan, T., and Arun Kumar, R. 2024. Sugarcane production technologies for changing climate scenario. In: Climate Resilience: Challenges and Opportunities. In Environmental Management. Abhishek Chandra, Shekher Chaturvedi, Rajasekaran, C. and Rao, K.S. (Eds.) SED India Publications, Noida, India. pp. 61-102.978-81-975795-5-4

Govindaraj, P., Meena, M.R., Ravinder Kumar, *et al.* (2024). Powering tomorrow: Advancements in energycane breeding for sustainable bioenergy solutions. In: Suresha, G.S., Krishnappa, G., Palanichamy, M., Mahadeva Swamy, H.K., Kuppusamy, H., Govindakurup, H. (Eds) Value Addition and Product Diversification in Sugarcane. Springer, Singapore. https://doi.org/10.1007/978-981-97-7228-5_16

Hemaprabha, G. and Mohanraj, K. 2024. Historical perspectives on sugarcane breeding for value addition. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 33-60 https://doi.org/10.1007/978-981-97-7228-5_2

Jambhulkar, P.P., Biju, C.N., Jeevalatha, A., Padamini, R., Parameshwari, B., Bhaskar, B., Karthikaiselvi, L., Anitha, K. and Biswas, K.K. 2024. Milestones in history of plant pathology. In: Concepts of plant pathology and disease management. Biswas, K.K., Sinha, P., Dutta, P., Jambhulkar, P.P., Bashyal, B.M., Behera, S., Hubballi, M. and Viswanathan, R. (Eds). Indian Phytopathological Society, New Delhi. pp. 27-44.

Jayakumar, V. 2024. Stress management in crop plants through nanotechnological approaches. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 30-37. ISBN 978-93-85267-42-0

Kasirajan, L., Kamaraj, K., Sebastiar, S., Thirugnanasambandam, P.P. and Karpagam, E. 2024. Proteomic approaches for ligninolytic enzymes production for enhancing sugarcane biomass conversion efficiency. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 175-200. https://doi.org/10.1007/978-981-97-7228-5_8

Kona, P., Sangh, C., Ravikiran, K.T., Ajay, B.C. and Kumar, N. 2024. Genetic and genomic resource to augment breeding strategies for biotic stresses in groundnut. In: Parihar, A.K., Bohra, A., Lamichaney, A., Mishra, R. and Varshney, R.K. (Eds). Genomics-aided Breeding Strategies for Biotic Stress in Grain Legumes. Springer, Singapore. https://doi.org/10.1007/978-981-97-3917-2_11.

Krishnapriya, V., Alagupalamuthirsolai, M., Arun Kumar, R. and Gomathi, R. 2024. Physiological and biochemical screening methodologies for drought and salinity tolerance. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter

School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 260-274. ISBN: 978-93-85267-42-0

Krishnapriya, V., Anusha, S., Vinu V., Nisha M., Adhini S.P., Prathima P.T., Arun Kumar, R., Alagupalamuthirsolai, M. and Gomathi, R. 2024. Sugarcane metabolomics and its applications in value addition. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 109–124 https://doi.org/10.1007/978-981-97-7228-5_5

Kumar N, Lata C, Kaur G, Dhansu P, Mann A, Kumar A, and Kumar A. (2024). Genetic treasures from halophytes: Unlocking salt Stress tolerance Genes. In: Halophytes vis-à-vis Saline Agriculture: Perspectives and Opportunities for Food Security, pp. 351-366. Singapore: Springer Nature Singapore.

Madhumathi, R., Raghavendar, S., Jegan, B., Naveenganesh and Arumuganathan, T. 2023. Transfer learning based nutrient deficiency prediction model for sugarcane crop. In: Lecture Notes in Networks and Systems, vol. 782 (Eds. Simon Fong, Nilanjan Dey and Amit Joshi), Springer Nature Singapore Pte Ltd. 2023, Singapore, pp. 207-215 (DOI: https://doi.org/10.1007/978-981-99-6568-7).

Mahesh, P. 2024. Biological control of sugarcane pests: An overview. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. p. 374. ISBN 978-93-85267-42-0.

Malathi, P. 2024. Mechanized priming of planting material for productivity increase in vegetatively propagated crops – sugarcane. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 124-131. ISBN 978-93-85267-42-0

Manimekalai, R., Mohanraj, K., Hemaprabha, G., Viswanathan, R. and Selvi, A. 2024. Tools for genomic selection (gs) and genome wide association studies (GWAS) for sugarcane breeding. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 80-87. ISSN: 978 - 93-85267-42-0

Meena, M.R., Pooja, Ravinder Kumar and Chhabra, M.L. (2024). Training manual" Unnat Ganna ganna Utpadan Tacnikiyan" SBIRC, Karnal (05-10 Feb 2024) p104.

Murali, P., Kuppusamy, H., Suresha, G.S. and Prakash, P. 2024. Economics of sugarcane value chain and policy capsules on value-added products. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 257–268. https://doi.org/10.1007/978-981-97-7228-5_13.

Namratha, P.M., Thirugnanasambandam, P.P., Swaliha, A. and Kasirajan, L., 2024. A recent update on metabolic engineering in plants, its futuristic applications with special inference to sugarcane value addition. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 295-310.

Palanichamy, M., Kuppusamy, H., Suresha, G.S. and Prakash, P. 2024. Economics of sugarcane value chain and policy capsules on value-added products. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 257-268. https://doi.org/10.1007/978-981-97-7228-5_13

Palaniswami, C., Kasthuri Thilagam, V. and Vennila A. 2024. Crop simulation and GIS for monitoring abiotic and biotic stress. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 201-208. ISBN 978-93-85267-42-0.

Ramesh Sundar, A. 2024. Host-Pathogen interaction: Exchange of molecular signatures. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. ISBN: 978-93-85267-42-0.

Sandip Garai, Vinayaka, Samir Barman, Ashish Ranjan Udgata, Nobin Chandra Paul, Ronit Jaiswal, Ramasubramanian V., Dhandapani, A. and Yashavanth B.S. 2024. Statistical modelling aspects of climate-resilient agriculture. In: Research and Technological Advances for Resilient Agriculture, NAARM publications. pp. 179-204.

Sankaranarayanan, C. 2024. Arbuscular mycorrhizal fungi to protect vegetable crops from pathogenic root-knot nematodes. In: Faheem Ahmad and Rakesh Pandey (Eds). Microbial Biostimulants: Biorational pesticides for management of plant pathogens. CRC Press, USA. pp. 107-124. ISBN 978-1-77491-624-7

Sankaranarayanan, C. 2024. Sugarcane - Nematode complex: polyspecific paradise. In Nematode problems of Crops and their management in south Asia. Walia, R.K. and Khan, M. R. (Eds). Cambridge Scholars Publishing, UK. pp. 277-290. ISBN :978-1-5275-5846-5

Satyavathi, C.T, Mukesh Sankar, S., Singh, S.P., Kapoor, C., Soumya, S.L., Ambawat, S., Khandelwal, V., Srivastava, R.K. and Gobu, R., 2024. Breeding climate resilient pearl millet cultivars for india. In: The Pearl Millet Genome. Cham: Springer International Publishing. pp. 31-55.

Satyavathi, C.T., Ambawat, S., Lata, C., Shivhare, R., Kapoor, C., Sankar, S.M., Gobu, R., Soumya, S.L., Siddaiah, C.N. and Srivastava, R.K. 2024. Allele mining for genome designing in pearl millet. In: Allele Mining for Genomic Designing of Cereal Crops. CRC Press. pp. 210-238.

Selvakumar, R. and Nithya, K. 2024. Real time diagnosis and management of sugarcane diseases. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 167-174. ISBN 978-93-85267-42-0

Sheelamary, S. 2024. Visit to ICAR-IARI station, Wellington-Evaluation of germplasm for low temperature tolerance. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 220-227.

Sobhakumari, V.P. 2024. Application of molecular cytogenetics to introgress novel traits in sugarcane cultivars. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 275-284.

Sreenivasa,V., Elayaraja, K., Mahadevaiah, C., Amudha, R., Annadurai, A. and Karuppaiyan, R. 2024. Sugarcane national distant hybridization facility and off-season nursery at ICAR-SBI. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 228-233.

Suganya, A., Mohanraj, K. and Appunu, C. 2024. Cytotaxonomy and data base development. In: Climate smart sugarcane agriculture for food and energy security in India. Hemaprabha, G. and Appunu, C. (Eds). (Course Manual of ICAR-sponsored Winter School. Jan 31 - Feb 20, 2024). ICAR-Sugarcane Breeding Institute, Coimbatore. pp. 38-52. ISBN 978-93-85267-42-0

Suresha, G.S., Kuppusamy, H., Palanichamy, M., Lavanya, R., Selvi, K., Krishnappa, G., Maruthi, R.T., Swamy, H.K. and Amaresh. 2024. Technological Interventions in the production of sugarcane juice concentrates. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 61-89. https://doi.org/10.1007/978-981-97-7228-5_3

Suresha, G.S., Kuppusamy, H., Palanichamy, M., Rajamani, L., Kalaimani, K., Krishnappa, G., Maruthi,

R.T., Swamy, H.K., Amaresh, Vinayaka and Kandasamy, E. 2024. Sugarcane fibre as dietary supplement, health benefits and applications in functional foods. In: Value Addition and Product Diversification Sugarcane. Suresha, G.S., Krishnappa, G., Murali, P., Mahadeva Swamy, H.K., Hari, K. and Hemaprabha, G. (Eds). Springer Nature, Singapore. pp. 323-335. https://doi.org/10.1007/978-981-97-7228-5_17

Technical / Popular Articles / Extension Publications / Pamphlets

Alagupalamuthirsolai, M., Murugan, M., Thankamani, C.K., Ashokkumar, K., and C. Sarathambal. 2023. Micro-climate modification for abiotic stress management in small cardamom. *Kishan World (A Journal of Agriculture and Rural Development)*. 50(4):17-20. ISSN 0971-9229

Anna Durai, Adhini S. Pazhany, Puthira Prathap, D., Hema Prabha, G. 2024. National hybridization garden: Celebrating fifty of years of service to the country (Pon Vizha Kanum Coimbatore Desiya Kalappina Serkkai Thottam) PART 1. *Sakthi Sarkarai Aalai Seithi Madal (Sakthi Sugars Newsletter)* 59 (1):26-28.

Anna Durai, Adhini S. Pazhany, Puthira Prathap, D., Hema Prabha, G. 2024. National hybridization garden: celebrating fifty of years of service to the country (Pon Vizha Kanum Coimbatore Desiya Kalappina Serkkai Thottam) PART 2. *Sakthi Sarkarai Aalai Seithi Madal (Sakthi Sugars Newsletter)*, 59 (2):22-25.

Anusha, S., Geetha, P., and Kannan, K. 2024. Weed management in Sugarcane. Extension Publication No. 347(2024E). ICAR-SBI, Coimbatore.

Anusha, S., Hari, K., Arun Kumar, R., Palaniswami, C., Puthira Prathap D., Singaravelu, B., Ramesh Sundar, A., and Murali, P. 2024. Digital Soil Moisture Sensor (DSMS), a portable, easy to use smart and farmer friendly device for irrigation scheduling. Extension Publication No. 348 (2024E). ICAR-SBI, Coimbatore.

Arumuganathan, T., Singh, A.K., Tayade, A.S., Anusha, S. Bakshi Ram and Senthil Kumar. T. Mechanization in sugarcane sett planting: need of the hour: Extension Publication No. 351 (2024E). ICAR-SBI, Coimbatore.

Chhabra, ML and Sachin Singhwal (2024). Uttar Bharat me Mehtavpuran Ganne ki Bimariyon ki Pehchan evon parbandhan. *In Training Manual*: Unnat Ganna ganna Utpadan Tacnikiyan. (Edit. Mintu Ram Meena, Pooja, Ravinder Kumar, and M. L. Chhabra), ICAR-SBIRC, Karnal pp 45-51.

Geetha, N., Salin, K.P. and Rajula Shanthy, T. 2024. White grub management in sugarcane – An integrated approach Part 1. *Sakthi Sugars Newsletter* (In Tamil) 59(4):20-23.

Geetha, N., Salin, K.P. and Rajula Shanthy, T. 2024. White grub management in sugarcane – An integrated approach Part 3. *Sakthi Sugars Newsletter* (In Tamil) 59(6):22-25.

Geetha, N., Salin, K.P. and Rajula Shanthy, T. 2024. White grub management in sugarcane – An integrated approach Part 4. *Sakthi Sugars Newsletter* (In Tamil) 59(7):18-20.

Geetha, N., Salin, K.P. and Rajula Shanthy, T. 2024. White grub management in sugarcane – An integrated approach Part 2. *Sakthi Sugars Newsletter* (In Tamil) 59(5):26-28.

Geetha, P., Gomathi, R., Anusha, S. and K. Kannan. 2024. Drought management and measures to improve irrigation water use efficiency in sugarcane. Extension Publication No. 349 (2024E). ICAR-SBI, Coimbatore.

Geetha, P., Shanthy, T.R., Palaniswami, C., Karuppaiyan R. and K. Kannan. 2024. Sugarcane Based Farming System. Extension Publication No. 350. ICAR-SBI, Coimbatore.

Gopi, R., Chandran, K., Nisha, M. and Mahendran, B. 2023. ICAR-SBI, Kannur Centre organizes a one-day exposure visit and entrepreneurship meet. *ICAR-SBI News* 45(2). p. 7.

Gopi, R., Chandran, K., Nisha, M., Mahendran, B., Sony Jayaraman., Gireesan. P.P. and Nici Ashok. 2023. Banded sclerotial disease occurrence in sugarcane germplasm at Kannur, Kerala. ICAR-SBI News 45(2). pp. 1-2.

Hemaprabha, G., Alarmelu, S., Mohanraj, K., Anna Durai, A. and Appunu, C. 2024. (தமிழ்நாட்டுக்கு உகந்த கரும்பு இரகங்கள்) (Sugarcane varieties suitable for Tamil Nadu). Technical bulletin no. STC/2023-24/Ta/04/Varieties. p 15.

Hemaprabha, G., Alarmelu, S. and Rajula Shanthy T. 2024. Promising sugarcane varieties. ICAR-SBI Extension publication No. 342. pp. 2.

Kasthuri Thilagam, V., Manivannan, S. and Srinivasan R. 2024. Crop Residue Management for sustaining soil health. *Agro India* 33(6):30-23.

Krishnapriya, V., Anusha, S., Vinu, V., Arunkumar, R., Alagupalamuthirsolai, M. and Gomathi, R. 2024. Recent insights on traits governing phosphorus use efficiency in agricultural crops. *AgriGate-An International Multidisciplinary e-Magazine* (ISBN: 978-81-965582-9-1) 4:174-180.

Kumari. S., Manimekalai. R., Appunu, C., Valarmathi, R., Ramesh Sundar, A. and Vishwanathan, C. 2025. Genome editing methods in sugarcane and its applications. (In Hindi). ICAR-SBI Technical Bulletin no: 346 (2024H). ICAR- SBI, Coimbatore.

Mahesh, P., Singaravelu B., Srikanth, J., Sankaranarayanan, C., Salin K.P. and Nirmala, R. 2024. Karumbu sagupadiyil verpuzhu melonmai (Tamil). Technical Bulletin STC/2022-23/Ta/02. ICAR-SBI, Coimbatore.

Mahesh, P., Singaravelu, B., Srikanth, J., Sankaranarayanan, C., Salin, K.P. and Nirmala, R. 2024. Karumbu sagupadiyil verppuzhu melaanmai (White Grub Management in Sugarcane Farming) In: Puthira Prathap, D., Mohanraj, K., Geetha, P. and Sreenivasa, V. (Eds) ICAR - SBI - STC Publication Series, No. STC/2022-23/Ta/02.

Malathi. P; Gopi, R. and M.L. Chhabra (2024). *Ganne Men rog prabandhan haitu mashinikarit priming prodhyogiki swasth nursery karykrm.* SBI, Coimbatore, Ext. Publ. No. 370(2024H).

Mahendran, B., Nisha M, Gopi, R and Dhanya V.G – ICAR Sugarcane Breeding Institute Research Centre, Kannur- A profile extension publication 361(2024E).

Mahesh, P., Srikanth, J., Singaravelu, B., Salin, K.P. and Mahendran, B. 2024. Web mite *Schizotetranychus krungthepensis* in sugarcane in India: occurrence, current status and management prospects, *ICAR-SBI News* 45(4):1-3.

Malathi, P., Viswanathan, R., Ravindra Naik, Ramesh Sundar, A., Rajula Shanthy, T., Vennila, A. and Ramasubramanian, T. 2024. Mechanized treatment of planting material using sugarcane sett treatment device. ICAR-SBI Extension publication No. 341. ICAR- SBI, Coimbatore, pp. 2.

Malathi, P., Rajula Shanthy, T., Ramesh Sundar, A., Selvakumar, R., Gopi, R., Vennila, A., Ramasubramanian, T. and Ravindra Naik. 2024. Healthy nursery programme for sustainable sugarcane agriculture – Role of mechanized sett treatment (Tamil). Extn. Publication No.345. ICAR- SBI, Coimbatore, pp. 6.

Malathi, P., RajulaShanthy, T., Ramesh Sundar, A., Selvakumar, R., Gopi, R., Vennila, A., Ramasubramanian, T. and Ravindra Naik. 2024. Management of pokkah boeng and crown mealy bug in sugarcane (In Tamil). ICAR-SBI Extension publication No. 359. pp. 2.

Malathi, P., T. Rajula Shanthy, Ramesh Sundar, A., Selvakumar, R., Gopi, R., Vennila, A., Ramasubramanian, T. and Ravindra Naik. 2024. Management of pokkah boeng and mealy bug in sugarcane (Tamil handout), ICAR-SBI Extension publication No. 359. ICAR- SBI, Coimbatore, pp. 2.

Malathi, P., Viswanathan, R., Ravindra Naik, Ramesh Sundar, A., Rajula Shanthy, T., Vennila, A. and Ramasubramanian, T. 2024. Mechanized treatment of planting material using sugarcane sett treatment device. ICAR-SBI Extension publication No. 341. pp. 2.

Manimekalai, R. and Solomon, S. 2024. Sugarcane Genome Editing - Potential & Way Forward. *ISMA times.*150-155.

Mintu Ram Meena, (2024). *Uttar Bharat meh prachlit ganne ki kismo ki pachan or lakshan varan.* In Training manual: *"Unnat ganna uttpadan taknikiyan* (Eds. Mintu Ram Meena, Pooja, Ravinder Kumar, and M. L. Chhabra), ICAR SBIRC, Karnal, pp 19-28.

Mintu Ram Meena, (2024). *Ganne ki jangali prajatiyon ka mahatav ttha urja ganne ganne ki upyogita*, In Training manual: *"Unnat ganna uttpadan taknikiyan* (Eds. Mintu Ram Meena, Pooja, Ravinder Kumar, and M. L. Chhabra), ICAR SBIRC,Karbnal, pp 41-44.

Murali. P., Vinayaka, Karuppasamy, S. and Hari Lakshman Raj, J. 2024. SugarcaneEdge (ABI): at a glance (English). Extension Publication No. 360 (2024E), ICAR-SBI, Coimbatore.

Prathap D. Puthira. 2024. From the Editor's Desk. Journal of Extension Education, 35(2), 6995. https://doi.org/10.26725/JEE.2023.2.35.6995

Prathap, D. Puthira. 2023. From the Editor's Desk. *Journal of Extension Education*, *35*(1), 6939. https://doi.org/10.26725/JEE.2023.1.35.6939

Puthira Prathap. D. 2024. Mecca of Sugarcane marching ahead (*Nootrandu kadanthu peedu nadai podum karumbin mecca*; (நூற்றாண்டு கடந்து பீடு நடை போடும் கரும்பின் மெக்கா). *Kalnadai velaanmai* , January-2024:32-35.

Rajula Shanthy, T., Jayabose, C. and Malakappa, B. Medegar. 2024. Success stories in tribal hamlets for improved livelihoods. ICAR-SBI Extension publication No. 362. pp. 4.

Rajula Shanthy, T., Jayabose, C., Arumuganathan, T. and Malakappa, B. Medegar. 2024. Success stories on drudgery reduction for tribal women. ICAR-SBI Extension publication No. 363. pp. 4.

Rajula Shanthy, T. 2024. How to identify the infestation of white grubs in sugarcane fields. *Pasumai Vikatan* (In Tamil) 18(4):12-13.

Ramasubramanian, T., Yogambal, C. and Singaravelu, B. 2024. Crown mealybug of sugarcane and its management. ICAR-SBI Extension publication No. 366 (2024E). pp. 4.

Ramasubramanian, T., Yogambal, C. and Singaravelu, B. 2024. (கரும்பைத் தாக்கும் குருத்து மாவுப் பூச்சி) ICAR-SBI Extension publication No. 367 (2024T). pp. 4

Rathinam, R.B., Sahu, T.K., Paul, N.C., Bag, K., Kumari, S., Kumar, R. and Tamilarasan, K. 2024. Bio teaming: Unlocking team synergy and lessons from nature for human team building. *Food and Scientific Reports* 5(7):30.

Ravinder Kumar, Mintu Ram Meena, Pooja, and M. L. Chhabra. 2024. Anuvaanshiki sudhar prakrya dwara uttar pachim kshetra ke liye pramukh ganna kismeh evm unka prabandhan, *In Training manual*: "Unnat ganna uttpadan taknikiyan", (Eds. Mintu Ram Meena, Pooja, Ravinder Kumar, and M. L. Chhabra), ICAR SBIRC, Karnal, pp 3-18.Ravinder Kumar, M.R. Meena, Pooja and M. L.Chhabra (2024). Ganna Kism Co 0118 ki pramukh sasy Kiryayen. Extension Publication No: SBIRC, Karnal/01/2024

Ravinder Kumar, M.R. Meena, Pooja and M.L.Chhabra (2024). Ageti Ganna Kisam Co 15023 ki Mukhya Sasya Kiryayen. Extension Publication No: SBIRC, Karnal/02/2024

Ravinder Kumar, M.R. Meena, Pooja and M. L. Chhabra (2024). Co 15023 (Karan 15) - An early maturing extraordinary sugarcane variety. Extension Publication No: SBIRC, Karnal/03/2024.

Selvakumar, R., Ramesh Sundar, A., Malathi, P., Ramesh, R., Jayakumar, V., Gopi, R., Jeevalatha, A. and Nithya, K. 2024. Pokkah Boeng in Sugarcane Farming. Extension Publication No. 368 (2024E). ICAR- SBI, Coimbatore, pp.4.

Selvakumar, R., Ramesh Sundar, A., Malathi, P., Ramesh, R., Jayakumar, V., Gopi, R., Jeevalatha, A. and Nithya, K. 2024. (கரும்பைத் தாக்கும் குருத்து முருக்கல் நோய்) . – arikurigal matrum melanmai (Tamil) Ext. Bulletin No. 369(2024T). ICAR- SBI, Coimbatore, pp.4.

Sheelamary, S., Lakshmi, K. and Boomiraj, K. 2023. Climate smart agriculture and food security. *Vigyan Varta* 4(8):31-35.

Sheelamary, S., Lakshmi, K. and Boomiraj, K. 2024. High throughput phenotyping for abiotic stress selection. *Vigyan Varta* 5(2):19-22.

Sheelamary, S., Lakshmi, K. Dhanapal, K. and Vivek Kumar, R. 2024. Concept of core collections of plant genetic resources. *Just agriculture* 5 (1) September. (e-ISSN: 2582-8223).

Sheelamary, S., Lakshmi, K., Dhanapal, K., Kumar, V.R., Ponselvan, A. and Vinith, N. 2024. The future of indian agriculture with aeroponic farming. *Vigyan Varta* 5(10):70-73.

Sobhakumari V.P. and Mohanraj K. 2024. Molecular cytogenetics in sugarcane – Protocol and its Application in introgression breeding. ICAR-SBI Technical Bulletin No. 357 (2024E). ICAR- SBI, Coimbatore.

Sobhakumari, V.P. 2024. Chromosome atlas on *Saccharum spontaneum* L., a wild species of sugarcane, from India. ICAR-SBI Technical Bulletin No. 356 (2024E). ICAR- SBI, Coimbatore.

Solomon, S., Priyanka Singh, R. and Manimekalai, R. 2024. Indian Sugar Outlook. *ISMA times* 1: 14-16.

Solomon, S.,, Manimekalai, R., Priyanka Singh, and Govindraj, P. 2024. Scripting the transformation roadmap of indian sugar industry: Role of R & D Institutions. *ISMA times* 1: 62-67.

Vennila, A., Kasthuri Thilagam, V. and Palaniswami, C. 2024. "A field guide on soil sampling and ready

reckoner for sugarcane nutrient management" (Tamil). Extension publication No. 371/2024/T. ICAR-SBI, Coimbatore.

Vennila, A., Kasthuri Thilagam, V., Palaniswami, C., and Malathi, P. 2024. Technology integration for maximizing profitability in sugarcane production system (Tamil). Extension publication No. 365/2024/T. ICAR-SBI, Coimbatore.

Presentation in conferences/symposia/seminars/ workshops/others

Adhini S. Pazhany, Remadevi, A.K and Premachandran, M.N. 2024. Genetic enhancement of sugarcane through cytoplasmic diversification. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 5.

Alarmelu, S., Anna Durai, A., Prabakharan, A.J., Govindaraj, P., Karuppaiyan, R., Appunu, C., Elayaraja, K., Mahadeva Swamy, H.K., Gopala Reddy, K., Adhini.S.Pazhany, Hemaprabha, G. and Shanthi. R.M. 2024. An appraisal of parents and their progenies for yield and quality traits in sugarcane (*Saccharum* spp.). In: Proceedings of 8th IAPSIT International Sugar Conference ISC-2024 & Sugarcon 2024' held from September 16-19, 2024 in Quy Nhon, Vietnam.

Alarmelu, S., Sheelamary, S., ArunKumar, R., Vasantha, S. and Anusheela, V. 2024. Assessment of drought tolerance of sugarcane (*Saccharum* spp.) hybrids using physiological and yield traits. In: Proceedings of 8th IAPSIT International Sugar Conference ISC-2024 & Sugarcon 2024' held during September 16-19th, 2024 in Quy Nhon, Vietnam.

Alarmelu, S., Sheelamary, S., Arunkumar, R., Vasantha, S., Anusheela, V., Mutharasu, S. and Karthick, M. 2024. Assessment of drought tolerant potential of prebred clones of *Saccharum* spp. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 6.

Alarmelu, S., Sheelamary, S., Vasantha, S., Anusheela, V., Arunkumar, R., Viswanathan, R., Mutharasu, S. and Karthick, M. 2024. Identification of disease resistant and climate resilient prebred clones of *Saccharum* spp. In: Proceedings of the National Conference on 'Plant Health for Food Security: Threats and Promises' held at ICAR-IISR-Lucknow held during 1-3rd February 2024.

Anusha, S., Geetha, P. and Krishnapriya, V. 2024. Selectivity and efficiency of herbicide application in sugarcane. In: Proceedings of Third International Conference and Exhibition on "Sustainability: Challenges and Opportunities in Global Sugar Industry" held during 12-14th January 2024 organized by Vasantdada Sugar Institute, Pune. ISBN No. 978-81-955713-7-6. p. 125.

Appunu, C., Harish Chandar, S.R., Surya Krishna Sakthivel, Sreenivasa, Venkatrayappa, Mahalakshmi Subramanian, and Prakasika Balakrishnan. 2024. CRISPR/Cas9 mediated genome editing for improved tolerance to drought and salinity stresses in Sugarcane. In: Proceedings of the 3rd International Conference & Exhibition on Sustainability: Challenges & Opportunities in Global Sugar Industry" held during 12-14th January 2024 at Vasantdada Sugar Institute, Pune. p. 63.

Appunu, C., Hemaprabha, G. and Ram B. 2024. Unveiling the potential of sugarcane genotypes across diverse growing environments through multi-trait stability analysis. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. pp. 36-37.

Ariharasutharsan, G., Pooja Negi, Vinoth, P., Malarvizhi, A., Senthilrajan, P., Appunu, C., Ashish K Srivastava, and Valarmathi, R. 2024. Unveiling the major cell wall related genes and their role in root formation in sugarcane. In: Proceedings of the Second National Genetics Congress, held during December 11-13rd, 2024. Section V: Genetics

and Nutrition, organized by the Indian Society of Genetics and Plant Breeding. p. 212.

Arumuganathan, T. 2024. Mechanization of small farm holdings for maximizing sugarcane productivity. In: Proceedings of All India Seminar on "Mechanisation of Sugarcane Farming: Operations, Environmental and Policy Constrains" organized by The Sugar Technologists Association of India, New Delhi held at ICAR-IISR, Lucknow on 7th March, 2024. pp. 31-49.

Arumuganathan, T., and Kannan, K. 2024. Technology demonstration of agricultural sprayer drone for input management of sugarcane crop in Ariyalur district of Tamil Nadu. In: Book of Abstracts of 3rd International Conference on Climate-Smart Nutri-Sensitive Integrated Farming System for Gender-Equitable Sustainable Agriculture: Prospects and Challenges (ICNSFS-2024). Mridula Devi, Ved Parkash Chaudhary, Sukanta Kumar Sarangi, Vijay Kumar, Ajit Pralhad Magar, Abhijit Khadatkar, Sachidananda Swain, Hariom Katiyar, Praveen Jakhar (Eds) held during November 06-08, 2024 at ICAR-Central Institute for Women in Agriculture, Bhubaneswar, Odisha, India. pp. 84-85.

Arun Kumar, R., Hemaprabha, G., Vasantha, S., Alarmelu, S., Mohanraj, K., Krishnapriya, V., Anusha, S., Sreenivasa, V., Gomathi, R., Palaniswami, C., Kannan, K., Alagupalamuthirsolai, M. and Arumuganathan, T. 2024. Variability in plant architecture and morpho-physiological traits in sugarcane for better productivity in tropical condition. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. pp. 52-53.

Devakumar,K., Rabisha, V.P., Vannish Ram, Aispriya, S., Arun Kumar, R. and Thirugnanasambandam, P.P. 2024. Exploring the genetic variablity for water use efficiency in sugarcane cultivars. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 65.

Gomathi, R. and Gururajarao, P.N. 2024. Deciphering source-sink association and its relevance to ratoonability of sugarcane under tropical conditions. In: Proceedings of "Frontiers in cell to whole Plant Physiology: Bridging Science and sustainability" NCPP-2024 at Kasaragod, Kerala.

Gomathi, R. and Venkataramana, S. 2024. Drought tolerance evaluation of *saccharum* species and interspecific hybrids in Tropical India. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. pp. 7-8.

Gomathi, R., Arun Kumar R., Pooja, Elayaraja, K., Krishnapriya, V., Gomathi Sharikha, S., and Valarmathi, R. 2024.Metabolic and molecular diversity of Tropical and Subtropical sugarcane varieties at tropical climate. In: Proceedings of The 8th IAPSIT—International Sugar Conference (ISC) 2024 and Sugarcon 2024 convened the professionals in sugarcane research and the sugar industry from September 16 to 19, 2024 at Vietnam.

Gomathi, R., Kohila, S., Arun Kumar, R., Krishna Priya, V. and Alagupalamuthirsolai, M. 2024. "Co 99004 -A source for evolving climate resilient thermotolerant sugarcane". In. 82nd STAI Annual Convention and "International Sugar Expo 2024" *Edited and Published by* The President STAI Association of India, New Delhi." ISBN-81 -85871-02-7. pp. 67-78 at Jaipur, Rajasthan.

Gomathi. R. 2024.Climate Resilient Sugarcane: adaptive mechanism of thermo-tolerance. In: Proceedings of the 8th IAPSIT - International Sugar Conference (ISC) 2024 and Sugarcon 2024, convened the professionals in sugarcane research and sugar industry held during Sep 16- 19, 2024 at Vietnam.

Gopi, R., Chandran, K., Nisha, M., Mahendran, B. and Viswanathan, R. 2024. Overview of diseases in

sugarcane germplasm at SBIRC, Kannur. In: Book of abstracts of the National Conference on Plant health for food security organized by Indian Phytopathological Society at ICAR-IISR, Lucknow, U.P. India from 1-3, February, 2024. p. 113.

Gopi, R., Chandran, K., Ramesh Sundar, A., Nisha, M., Mahendran, B. and Viswanathan, R. 2024. Occurrence of false floral smut in the world's largest sugarcane germplasm. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 55.

Harish Chandar, S.R., Surya Krishna Sakthivel, Mahalakshmi Subramanian, Girija Sangari Murugavelu, Shanmugapriya Palanisamy, Appunu Chinnaswamy. 2024. Genome Engineering of TCP Transcription Factor: A Strategy to enhance abiotic stress tolerance in sugarcane. In: Proceedings of the National Conference on Prospects of Biotechnology in Agriculture (NCPBA-2024) at KIT-Kalainarkarunanidhi Institute of Technology, Coimbatore held on 30th January 2024. p. 37.

Karthigeyan, S., Adhini S. Pazhany, Sheelamary, S., Mahadeva Swamy, H.K., Dhanapal, K. and Govindaraj, P. 2024. Latitudinal displacement and flowering in recent *Saccharaum spontaneum* germplasm collections conserved *ex-situ* under Coimbatore condition, Tamil Nadu, India. In: Proceedings of the National Conference on Prospects of Biotechnology in Agriculture (NCPBA-2024) at KIT-Kalainarkarunanidhi Institute of Technology, Coimbatore held on 30th January 2024. p. 56.

Kasthuri Thilagam, V., Vennila, A. and Palaniswami, C. 2024. Characterization of waterlogged soil under sugarcane cultivation for their hydraulic properties and nutrient status. In: Book of Abstracts, 32nd National Conference on "Soil, Water and Energy Management for Sustainable Agriculture and Livelihood Security". Munish Kumar, TBS Rajput, T.B.S, Kaushal Kumar, Sarvesh Kumar, Mukesh Kumar and Kanaujia, V.K. (Eds) held during October 18-20, 2024, at Chandra Shekhar Azad University of Agriculture &Technology, Kanpur. P. 248.

Krishnapriya, V., Karpagam, E., Arunkumar, R., Gomathi, R., Vasantha , S., Chandran, K., Nisha, M., Gopi, R., Mahendran, B., Anusha, S., Vinu, V. and Alagupalamuthirsolai, M. 2024. Genotypic diversity in sugarcane root phenes: exploring the *Saccharum* complex and allied genera under drought and waterlogging stress. In Book of Abstracts: Roots [& Roads] to a Sustainable Future, held during 2-7 June 2024 at Leipzig, Germany. p 227.

Lakshmi, K., Sheelamary, S., Keerthana, K., Ram Vanish, Rabisha, V.P., Anna Durai, A., Suganya, A., Selvi, A., Gomathi, R., Deva Kumar, K., Gayathri, K., Savitha. S. and Karpagam, E. 2024. Identification and Characterization of Novel Homeodomain Leucine Zipper-1 (Hdlz-1) Transcription Factor associated with drought tolerance in sugarcane Inter-Specific Hybrid. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 66.

Lakshmi, K., Thirugnanasambandam, P.P. and Karpagam, E. 2024. CRISPR-Cas9 editing of ferulate 5 hydrolaxse (f5h) in sugarcane to improve lignocellulosic saccharification efficiency. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. pp. 40-41.

Madhumathi, R., Ashok Kumar, K., Chandra Kumar, N., Dhyanesh, A. and Arumuganathan, T. 2023. Soil nutrient prediction and crop recommendation system. In: International Conference on Circuit Power and Computing Technologies (ICCPCT) held during 10-11th August 2023 at Baselios Mathews II College of Engineering, Kollam, Kerala. *IEEE Xplore*, pp: 976-981. DOI: 10.1109/ICCPCT58313.2023.10245685

Madhumathi, R., R. Dhanishtaa, E., Elakkiya, R., Gunashri and Arumuganathan, T. 2023. Prediction of soil fertility using ML algorithms and fertilizer recommendation system. In: Proceedings of the International Conference on Self Sustainable Artificial Intelligence Systems (ICSSAS) held during 18-20th October 2023 at M.P. Nachimuthu M.J aganathan Engineering College, Erode, *IEEE Xplore*, pp. 313-317. DOI: 10.1109/ICSSAS57918.2023

Mahadeva Swamy, H.K., Hemaprabha, G., Mohanraj, K., Appunu, C., Manimekalai, R., Viswanathan, R., Malathi, P., Mahesh Kumar, E., Vinith, Prabakaran, A.J., Anna Durai, A. and Sreenivasa, V. 2024. Development of association mapping panel and Identification of markers for red rot resistance in sugarcane. In: Viswanathan, R., Dinesh Singh, Dinesh Singh, Goswami, S.K., Chandramani Raj, Shweta Singh, Lalan Sharma, Biswas, K.K., Arun Baitha, and Rahul Kumar Tiwari (Eds). National Conference on Plant Health for Food Security: Threats and Promises, 1-3 February 2024, ICAR-Indian Institute of Sugarcane Research, Lucknow. pp. 115-116.

Mahadeva Swamy, H.K., Hemaprabha, G., Mohanraj, K., Appunu, C., Manimekalai, R., Vinith, N. and Gopalareddy, K. 2024. Molecular diversity and population structure of the drought panel and identification of markers associated with drought tolerance in sugarcane. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 34.

Mahesh, P., Singaravelu, B., Srikanth, J., Hari, K., Salin, K.P., Appunu, C., Suresha, G.S, Sankaranarayanan, C., Nirmala, R. and Ishwarya, B. 2024. Mass production of *Bacillus thuringiensis* on agro-industry by-products for the control of white grub *Holotrichia serrata* in sugarcane. In: Proceedings of the International Conference on Microbial Research: Current Challenges and Perspectives (ICMR: CCFP-2024), held January 9-11th , 2024, Bharathidasan University, Tiruchirapalli, Tamil Nadu, India.

Mahesh, P., Singaravelu, B., Srikanth, J., Salin, K.P., Chandran, K., Mahendran, B. and Nirmala, R. 2024. Identification of sources of resistance among sugarcane hybrids to *Chilo sacchariphagus indicus* (Lepidoptera: Crambidae): In: Proceedings of the 6th International Conference on "Cutting-Edge Solutions in Science-Agriculture, Technology, Engineering and Humanities"(CSATEH-2024), held during August 24-26th , 2024, Kumaun University, Nainital, Uttarakhand, India.

Mahesh, P., Singaravelu, B., Srikanth, J., Salin, K.P., Chandran, K., Mahendran, B. and Nirmala, R . 2024. Internode borer (*Chilo sacchariphagus indicus*) resistance in sugarcane hybrids. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 14.

Malathi, P., Viswanathan, R., Ramesh Sundar, A., Kaverinathan, K., Elamathi, E. and Shweta Singh. 2024. Integrated management of red rot in sugarcane by efficient delivery of fungicides and bioagents'. In: Proceedings of "National Symposium on Plant Health for Food Security: Threats and Promises" held during 01-03rd February, 2024 at IISR, Lucknow. pp. 191-192.

Malathi, P., Viswanathan, R., Ramesh Sundar, A., Ravindra Naik, Selvakumar, R., Jayakumar, V., Gopi, R., Nithya, K., Vennila, A., Ramasubramanian, T. and Rajula Shanthy, T. 2024. Efficient and economical way of delivering agro-inputs for Improved resource use efficiency in sugarcane. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. pp. 57-58.

Malathi, P., Ramesh Sundar, A., Hari, K., Selvakumar, R., Jayakumar, V., Gopi, R., Nithya, K., Vennila, A., Ramasubramanian, T. and Rajula Shanthy, T., (All

from ICAR-SBI); Viswanathan, R. and Shweta Singh (IISR); Ravindra Naik (CIAE); Veena, S.S., Jeeva, M.L and Makeshkumar, T (CTCRI); Ravichandran,V (TNAU); Priti Sonavane and Sriram, S. (IIHR); Thangavelu, R and Loganathan, M (NRCB); Biju, C.N. and Sellaperumal, C. (IISR-Spices).2024. Mechanized Priming of planting material in vegetatively propagated crops – An innovative technology to protect seed and crop Health. In: Proceedings of the International Conference on "Unleashing the Power of Seed and Crop Health Innovations for a Food Secure World, ICUCF2024" held during November 21-22nd, 2024, at Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu.

Malathi, P., Ramesh Sundar, A., Selvakumar, R., Gopi, R. and Ramasubramanian, T. 2024. "Management of pokkah boeng in Sugarcane". In: Proceedings of 53nd Annual Convention of SISSTA" held during 19-20th August, 2024 at Sheraton Grand Hotel, Prestige Shantiniketan, Hoodi, Whitefield, Bengaluru - 560048, Karnataka.

Manimekalai, R., Viswanathan, R., Karen, A., Lakshmanan, P., Jackson, P., Keerthana, S., Nandhini, M., Mohanraj, K., Selvi, A. and Hemaprabha, G. 2024. SNP markers for red rot resistance in sugarcane through Genome wide association studies. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 43.

Mohanraj. K., Meena, M.R., Mahadeva Swamy, H.K. and Suganya, A. 2024. Identification of potential sources of resistance to red rot in sugarcane involving the wild relative *Erianthus procerus*. In: Proceedings of the National Conference on Plant Health for Food Security: Threats and Promises held during February 1-3rd, 2024, at ICAR-IISR Lucknow. pp. 8-9.

Murali, P, Birthal, P.S., Jagadeshwaran, P., Puthira Prathap, D., Hari, K., Govindaraj, P and Rajni Jain. 2024. Impact of variety Co 0238 on sugarcane value chain management during pre-conference workshop In: Proceedings of the 32nd Annual Conference on "Digitalization of Agriculture for higher, Sustainable, and Inclusive Growth" held during 10-13th December 2024 at The Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, Chhattisgarh. Organized by Agricultural Economics and Research Association, New Delhi.

Murali, P., Niranjan, S., Hari, K., Puthira Prathap, D. and Kumaravel, K.S. 2024. Impact of Indian Sugar Production on Global Sugar Trade: RCA and Gravity Model Approach. In: Proceedings of the International Conference of Agricultural Economists (ICAE) held during 2-7th August 2024 in New Delhi, India. Organized by International association of Agricultural Economist (IAAE), USA.

Nilanjana Nina and Thirugnanasambandam, P.P. 2024. Comparative analyses of key enzymes of sucrose metabolism in sugarcane and related species. In: Proceedings of the National conference on Multiomics nad structural biology in redefining therapeutics-Motif, held during 24-21st March 2024 at Bharathiar University, Coimbatore, Tamil Nadu. p. 35.

Nisha M, Chandran K, Lakshmipathy, Gopi R, and Mahendran B.2024. Morphological and molecular characterization of *saccharum barberi* clones available in the field gene bank in Sandhya gupta asn SK Malik (Eds). Proceedings of the X international International Scientific and Practical Conference on Biotechnology as an Instrument for Plant Biodiversity Conservation (physiological, biochemical, embryological, genetic and legal aspects) 19th - 21st November 2024 at NASC Complex, New Delhi, India p 46.

Palaniswami, C., Vennila, A. and Kasthuri Thilagam, V. 2024. Interventions for improving sugarcane yields in Southern Karnataka. In: Compendium of Research articles & Status papers- 22nd Sugarcane Research & Development Workshop of Southern Karnataka. Puthira Prathap,D., Murali,P. and Hemaprabha, G. (Eds) held during June 20-21, 2024 at Mysuru, Karnataka. pp. 37-42. ISSN 0973-8185

Prathap, D. Puthira, and Murali, P. 2024. Spread, scaling and sustainability of sugarcane varieties: the successful case of Co 86032 in tropical India In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane

Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 13.

Punithavalli, M. and Salin, K.P. 2024. Spatial distribution of silicon in the *Saccharum spontaneum* and *Erianthus arundinaceus* energy canes and their relationship with sugarcane borer pests. In: Proceedings of the International Conference on "Current Innovations and Technological Advances in Agriculture and Allied Sciences (CITAAS 2024)" held during 29-31st August, 2024 at Guru Kashi University, Punjab (Online mode). p. 31

Punithavalli, M., Mohanraj, K. and Salin, K.P. 2024. Field reaction of intergeneric sugarcane hybrids (*Saccharum spontaneum* x *Erianthus arundinaceus*) against sugarcane borers. In: Proceedings of the International Conference on "Current Innovations and Technological Advances in Agriculture and Allied Sciences (CITAAS 2024)" held during 29-31st August, 2024 at Guru Kashi University, Punjab (Online mode). p. 167.

Punithavalli, M., Mohanraj, K. and Salin, K.P. 2024. Screening of intergeneric sugarcane hybrids involving *Erianthus procerus* X commercial sugarcane varieties for resistance against sugarcane borers. In: Proceedings of the International Conference on "Recent Advances in Agriculture, Engineering, Applied & Life Sciences for Environmental Sustainability" (RAAEALSES-2024) held during 23-25th October, 2024 at Uttaranchal University, Dehradun, Uttarakhand. p. 91.

Punithavalli, M., Mohanraj, K. and Salin, K.P. 2024. Silicon profiling in the sugarcane varieties and their relationship with the incidence of borer pests. In: Proceedings of the International Conference on unleashing the power of seed and crop health Innovations for a food secure world" held during 21-22nd November, 2024 at Tamil Nadu Agricultural University, Coimbatore. p. 162.

Raja, P., Annepu, S.K., Surendran, U., Suguna, A.R., Kannan, K., Gurudevan S. and Gayathri, P. 2024. Carbon footprint studies in the Nilgiris region for the sustenance of temperate ecosystem of the Western Ghats, Southern India. In: Proceedings of National Conference on Living with Nature: Soil, Water, and Society in Ecosystem Conservation, during 20-22, June, 2024, at ICAR-Indian Institute of Soil and Water Conservation, Dehradun. pp.139-140.

Sankaranarayanan, C. 2024. EPN Strains evaluation and preparedness for commercialization. In: Book of Abstracts of the national symposium on "Nematodes: The Unseen Foes and Friends of Plant and Soil Health" held during January 31 to February 2nd, 2024, at Indian Statistical Institute, Kolkata, West Bengal. p. 23.

Selvi, A., Manimekalai, R., Prathima, P.T., Lakshmi, K., Devakumar, K., Ram Vannish and Rabisha, V.P. 2024. Sugarcane drought transcriptome: A resource for high throughput discovery of functionally relevant SSRs and SNPs. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 35.

Shanthi, R.M., Hemaprabha, G., Anna Durai, A., Alarmelu, S., Mohanraj, K., Lakshmi Pathy, T., Viswanathan, R., Ramesh Sundar, A., Malathi, P., Selvakumar, R. and Jayakumar, V. 2024. Multiple stress tolerant parental clones for use in sugarcane breeding programmes in India. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 61.

Sheelamary, S., Lakshmi Pathy, T., Karthigeyan, S., Jayabose, C., Vinu, V., Nisha, M., Dhanapal, K. and Vinith, N. 2024. Characterization of wild sugarcane (*Saccharum spontaneum* L.) Germplasm Conserved in the Field Genebank in India and development of core collection. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for

Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 62.

Singaravelu, B., Suresha, G.S., Appunu, C., Crickmore, N., Shu, C., Zhang, J., Srikanth, J., Hari, K., Sankaranarayanan, C., Mahesh, P., Nirmala, R., Om Prakash, M. and Athira, K.M. 2024. Scarabid-specific *Bacillus thuringiensis* crystal toxin cry8 for development of white grub resistant transgenic sugarcane in India. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. pp. 38-39.

Sobhakumari, V.P. and Mohanraj, K. 2024. Explore the resource efficiency for the development of climate smart sugarcane varieties through pre-breeding and molecular cytogenetic techniques. 2024. In: Proceedings of ISSCT 13th Germplasm and Breeding/10th Molecular biology workshop during 8-12 July, 2024. ICAR-Sugarcane Breeding institute, Coimbatore, Tamil Nadu, India. p. 4.

Sreenivasa, V., Mahadevaiah, C., Amaresh, Mahadeva Swamy, H.K., Appunu, C. and Hemaprabha, G. 2024. Unravelling the performance of Coimbatore (Co canes) clones for yield and quality traits using AMMI and GGE biplot methods In: Proceedings of the '3rd International Conference & Exhibition on Sustainability: Challenges & Opportunities in Global Sugar Industries held during 12- 14th January 2024 at VSI, Pune, Maharashtra. p. 5.

Suganya, A., Lakshmi, K., and Sandhya, M. 2024. North east collections of sugarcane genetic resources and their utilization for climate resilience. In: Proceedings of the National Conference on Management of Biodiversity in North Eastern India (NCMAN-2024). p. 15.

Suganya, A. and Lavanya. 2024. Flow cytometric ploidy analysis of Erianthus *arundinaceus* (Retz.) Jeswiet with different chromosome number''. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 64.

Suganya, A., Salin, K.P., Krishnapriya, V. and Sandhya, M. 2024. Biochemical and endogenous growth hormone changes during meristem tip culture of exotic and Indian clones of sugarcane *(Saccharum officinarum L.)*. In: Proceedings of 8th IAPSIT International Sugar Conference ISC-2024 & Sugarcon 2024' held during September 16-19th, 2024 in Quy Nhon, Vietnam. p. 113.

Suresha G.S., Swathi, S., Malini, P., Darshini, S., Ashwin, N., Swathi, P.C., Appunu, C., Krishnapriya, V., Valarmathi, R., Mahdevaswamy, H.K. and Hari, K. 2024 vacuolar targeting of invertase inhibitors enhances sucrose accumulation in sugarcane. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 41.

Swathi, T. and Appunu, C. 2024. Metabolomic insights into sugarcane stem vacuole-Implications of product diversification. In: Proceedings of the National Conference on Prospects of Biotechnology in Agriculture (NCPBA-2024) held on 30th January 2024 at KIT-Kalainarkarunanidhi Institute of Technology, Coimbatore.

Swathi, T. and Appunu, C. 2024. Vacuole isolation in sugarcane stems: proteomics unravelling for agricultural and bio-industrial innovations. In: Proceedings of the International Conference on Innovations in Life Sciences (ICILS'24) held during 12-13th February 2024 by Dept of Biochemistry, SRM Institute of Science and Technology, Kattankulathur. p. 43.

Thirugnanasambandam, P.P., Nilanjana Nina, V., Afseena, A. and Namrata, P.M. 2024. Comparative analyses of sucrose phosphate synthase genes in the sugarcane hybrid and progenitor species through long read sequencing. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI),

Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 62.

Thirugnanasambandam, P.P., Swaliha, B., Lakshmi, K., Selvi, A., Manimekalai, R. and Krishnapriya, V. 2024. Towards low GI sugarcane: identification and characterization of genes for novel low glycaemic sugars. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 68.

Valarmathi, R., Appunu, C., Sudhagar, R. and Niranjan Baisakh. 2024. Tiller node proteins differentially accumulated in sugarcane genotypes. The Plant and Animal genome conference (PAG31), Jan12-17, 2024, San Diego, California, USA. Organized by Scherago International. p. 226.

Valarmathi, R., Malarvizhi, A., Vinoth, P., Ariharasutharsan, G., Senthilrajan, P., and Appunu, C. 2024. Deciphering the leaf morpho-anatomical plasticity in sugarcane wild relative *Erianthus arundinaceus* under salinity stress conditions. In: Proceedings of the International Salinity Conference (ISC-2024) Rejuvenating Salt Affected Ecologies for Land Degradation Neutrality under Changing Climate held during 14-16th February 2024 organized by ICAR-Central Soil Salinity Research Institute, Karnal. p. 42.

Valarmathi, R., Vinoth, P., Appunu, C., Mohanraj, K., Gandham, P., Ariharasutharsan, G., Malarvizhi, A. and Niranjan Baisakh. 2024. Deciphering the molecular mechanisms controlling tiller development in sugarcane to improve sugarcane plant architecture and yield through CRISPR/Cas9 mediated genome editing. In: Book of Abstracts on "The ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop" organized by International Society of Sugar Cane Technologists (ISSCT), ICAR-Sugarcane Breeding Institute (SBI), Coimbatore and Society for Sugarcane Research and Development (SSRD), Coimbatore held during 8-12th July, 2024 at ICAR-SBI, Coimbatore, India. p. 42.

Vinoth, P., Malarvizhi, A., Ariharasutharsan, G., Senthilrajan, P., Appunu, C. and Valarmathi, R. 2024. Effect of salinity stress on photosynthesis, malondialdehyde formation and proline content in sugarcane wild relative *Erianthus arundinaceus*. In: Proceedings of the International Salinity Conference (ISC-2024) Rejuvenating Salt Affected Ecologies for Land Degradation Neutrality under Changing Climate held during 14-16th February 2024 organized by ICAR-Central Soil Salinity Research Institute, Karnal. p. 84.

11

Research Projects

1. Breeding superior sugarcane varieties of different maturity with improved cane yield, quality and resistance to biotic and abiotic stresses
2. Enhancement of sugarcane germplasm and development of pre-breeding material
3. Sugarcane genomics and molecular markers
4. Gene discovery and genetic transformation in sugarcane
5. Development of cropping systems and improved agronomic practices to enhance sugarcane productivity
6. Doubling income of small farms through sugarcane-based farming system (NADP/RKVY)
7. Enhancing physiological efficiency of sugarcane
8. Sub-cellular targeting of invertase inhibitory proteins: a novel approach to enhance sucrose yield in sugarcane
9. Natural resource management for enhancing productivity and sustainable sugarcane production
10. Host resistance, interactomics, pathogen variability, diagnosis and disease management in sugarcane
11. Studies on sugarcane pest and their management
12. Basic and applied studies of sugarcane phytonematodes and entomopathogenic nematodes
13. Economic and statistical studies in sugarcane and sugar production system
14. Transfer of sugarcane technologies
15. Standardization of true seed production technique through developing homozygous parental lines and apomixes
16. Value addition and product diversification in sugarcane
17. All India Coordinated Research Project (Sugarcane)
18. All India Coordinated Research Project on Biological Control
19. AICRP on Seed (Crops)-Sugarcane
20. All India Network Project (AINP) on soil arthropod pests Management of white grubs through EPN and Bt
21. All India Network Project (AINP) on Biotech crops

12

Consultancy Services, Intellectual Property, Technology Management & Commercialization

Intellectual property, Technology management and Commercialization

- Five ITMC meetings and Three Techno Commercial Assessment Agrinnovate Tripartite meetings were conducted to take decisions on different aspects pertains to technology disclosures, patent, trademark applications and commercialization of technologies developed by ICAR-SBI.
- World IP day was celebrated by ICAR-SBI by conducting a seminar on 30 April 2024. Dr Sudha, Professor and Head, and Dr. Priya, Professor of KPR institute of science and technology, Coimbatore presented lectures on Role of AI and IoT in Agriculture and Intellectual Property Rights respectively to sensitize ICAR-SBI staff. Dr. Kannan, Head, Division of Crop Production and Chairman Copyright committee has organised a zoom meeting titled "Applying copyright for Publications" by Dr. Anupam Barh, Scientist, ICAR-IISWC on 29 August 2024 at ICAR-SBI, Auditorium.
- Member secretary participated in the meeting organized by Secretary, Ministry of Agriculture & Farmers Welfare, Government of India, New Delhi to brief about the Digital Soil Moisture Sensor (DSMS). Department of Agriculture and Farmers Welfare, Government of India has recognized and issued office orders directing all the agricultural department Secretaries of state government and Union territories to procure and distribute DSMS to the beneficiaries. DSMS has been included in the schemes *viz*., (a) Sub Mission of Agricultural Mechanization (SMAM), (b) National Food Security Mission (NFSM) and (c) more crop per drop scheme for water conservation with subsidy to the extant of 50% to SC/ST/ OBC/women and for others 40%, for the benefit farmers and other stakeholders. ICAR-SBI-CIAE Sett treatment device and ICAR-CIAE-SBI EPN applicator, were included in the Sub Mission of Agricultural Mechanization (SMAM) 2024 by the Department of Agriculture and Farmers welfare.
- Demonstrations were given to 15 officials from Department of agricultural engineering, Government of Tamil Nadu with a team of 40 farmers at ICAR-SBI on DSMS and ICAR-SBI CIAE Sett Treatment

Device. Demonstration on DSMS technology was given in the farmers in a meeting organised by The Coimbatore District Collector.

- Received registration certificates for Co 09004 (Amritha), Co 10026 (Upahar), Co 11015 (Atulya) Co 12009 (Sankalp) and Co 15023 (Karan 15) from PPV&FRA. An application was submitted to PPV&FRA as extant variety for 'Sugarcane Co 18009'. Annual maintenance fee for four varieties were paid to PPVFRA along with annual return forms.
- Two patents were granted *viz*., (a) Rapid treatment for planting materials of sugarcane and other vegetatively propagated crops by Malathi *et al*. with patent no.: 516028, application no.: 3323/CHE/2011 on 27 February 2024 and (b) Vacuolar targeting for plants and uses thereof by Subramoni *et al*. with patent no.: 526939, application no.: 5384/CHE/2013, on 15 March 2024. One design patent was granted to 'Parasitoid release station' on 13.06.2024. Submitted one bacterial culture with ICAR-NAIMCC, NBAIM, Mau as *Bacillus thuringiensis* Bt 41 and received an accession No. NAIMCC-IDA-7 having novel cry genes by Singaravelu *et al*.
- A patent application titled 'Process of preparation of freeze dried 100% chemical free, free flow, clog free, mineral-rich natural sugarcane juice granules and uses there off' by Hari, K., Suresha, G. S, Sivaraman, K, Sivaraj, P and Murali, P was submitted to The Controller of Patents, Chennai and received an application number: 202441008502 dated 08 February 2024. One trademark application was submitted along with documental proof from 1925 to 2024 for 'Co' under trademark class No. 31 on 18 November 2024 with trademark application No. 6714274.
- Four Form 2 applications were submitted to NBA pertaining to Transfer of research results to a third party with foreign participation for commercialization pertaining to export of varieties and energycane to countries like Guyana, Indonesia, and Australia were perused.
- Five new technology disclosures received *viz*., (1) Transfer of *Cotesia flavipes* and *Telnomus dignus* multiplication technology against internode borer by P. Mahesh, J. Srikanth, K.P. Salin, B. Singaravelu and R. Nirmala (2) Field-release station for dispensing parasitoids in the field for pest control by J. Srikanth, P. Mahesh, M. Punithavalli and K.P. Salin (3) "Iniya" -Potassium rich Powder Jaggery, a product of ICAR-SBI by R. Gomathi, G. Hemaprabha, R. Karuppaiyan, T. Arumuganathan, P. Murali, G.S. Suresha, P. Geetha, M. Alagupalamuthirsolai, R. Arun Kumar, U. Dinesh, R. Raja and P. Amsaveni (4) ICAR-CIAE-SBI Small tractor operated EPN applicator for Sugarcane white grub management by T. Senthilkumar, Syed Imran, T. Arumuganathan, C. Sankaranarayanan, and M. Rajesh Kumar and (5) ICAR IISR SBI Deep furrow sugarcane cutter planter suitable for tropical region by T. Arumuganathan, Bakshi Ram and A.S. Tayade were received, and four were approved by ITMC for commercialization.
- Licensed Soil Moisture Indicator technology to M/s WS Telematics Private limited, New Delhi for Rs. 0.85 lakhs. This technology has also realized a revenue as royalty of Rs. 0.63 lakhs. SBIEC14006 - An Energycane with High biomass production was licensed to one firm M/s Hriday Hydrogen Revolution Forum, Mumbai, Maharashtra which has realized Rs. 3.35 lakhs. Licensed standardized liquid jaggery technology to three firms *viz*., (a) M/s Panaivi Naturals, Tirupur, Tamil Nadu, (b) M/s Kalai Exim, Dindivanam, Tamil Nadu and (c) M/s JK Foods, Shivamogga, Karnataka, which has realized a revenue of Rs. 0.36 lakhs. Licensed ICAR-SBI EPN Biopesticide formulation to three firms' *viz*., (a) M/s Bannari Amman Sugars Ltd, (b) M/s Bharti Green tech, Maharashtra and (c) M/s Eco Bugs India Private Limited, Thanjavur, Tamil Nadu for Rs. 6.25 lakhs. Production of cane jam from sugarcane juice was licensed to one firm, M/s Shree Pancham Shivalingeshwar Jaggery and Agriculture Products, Karnataka has realized a revenue of Rs. 0.85 lakhs. Licensed *Cotesia flavipes* and *Telenomus dignus* mass multiplication technology against internode borer with release station to two firms *viz*., (a) M/s E.I.D. - PARRY (India) Limited, Karur, Tamil Nadu and (b) M/s Bannari Amman Sugars Limited, Erode, Tamil Nadu which has realized Rs. 1.20 lakhs. Licensed ICAR-CIAE-SBI- Small Tractor Operated EPN Applicator for Sugarcane white grub management to M/s Greenfield Equipment India Private Limited, Coimbatore, Tamil Nadu realized Rs. 0.45 lakhs revenue. ICAR-SBI CIAE Sett Treatment Device was licensed to M/s CLEANTEK, Coimbatore which has realized Rs. 2.25 lakhs. A total of thirteen MoUs were signed during the period and the commercialization activity has realised Rs. 16.20 lakhs through licensing and royalty and paid a GST of Rs. 2.88 lakhs.

SMI and DSMS demonstrated to Shri. Kranthi Kumar Pati I.A.S., District Collector, Coimbatore at The District collector office

SMI and DSMS demonstrated to farmers in a meeting organised by Coimbatore District Collector, Coimbatore

DSMS being introduced to 40 farmers and 15 agricultural engineering Department Officials

SSTD being demonstrated to 40 farmers and 15 agricultural engineering Department Officials

Dr. S.V. Sudha, Professor KPR Institute of Engineering and Technology, Coimbatore delivered lecture in World Intellectual Property (WIP) Day seminar on Role of AI and IoT in Agriculture

Dr. A.K. Priya, Professor from KPR Institute of Engineering and Technology, Coimbatore delivered a lecture in World Intellectual Property (WIP) Day seminar on Intellectual Property Management

Dr. Anupam Barh, Scientist, ICAR-IISWC delivered a lecture on "Applying copyright for Publications"

PPV&FRA

प्रपत्र O-2, FORM O-2

(नियम 36 और 37 देखें) (See rules 36 and 37)

भारत सरकार / GOVERNMENT OF INDIA

पौधा किस्म रजिस्ट्री PLANT VARIETIES REGISTRY

पौधा किस्म और कृषक अधिकार संरक्षण प्राधिकरण/PROTECTION OF PLANT VARIETIES & FARMERS' RIGHTS AUTHORITY

सी.पी.एस. मार्ग, निकट टोबाकुर गाँव, नई दिल्ली – 110012 / D.P.S Marg, Near Todapur Village, New Delhi - 110012

रजिस्ट्रीकरण प्रमाण-पत्र /Certificate of Registration

पंजीकरण सं./ Registration No.: REG/2019/76

पंजीकरण करने की तारीख/Date of Filing: 06 मई / May , 2019

जारी करने की तारीख/ Date of Grant: 13 जून / June , 2024

भारतीय कृषि अनुसंधान परिषद्, कृषि भवन, नई दिल्ली-110001, दिल्ली ने घोषित किया है कि उसने गन्ना (Saccharum L.) प्रजाति की नई पौधा किस्म Co 09004 (Amritha) विकसित किया है और वह उसका पारंपरिक उत्पन्नकर्ता (या उसकानिधिक प्रतिनिधि या उत्तराधिकारी) है और पौधा किस्म संरक्षण और कृषक अधिकार अधिनियम, 2001 के उपबंधों को ध्यान में रखते हुए वह उस पौधा किस्म के अधिकार का हकदार है और यह कि उसको उस में पौधा किस्म के पंजीकरण के प्रति कोई आक्षेप नहीं है।

और, वह उक्त पौधा किस्म के लिए आवेदन करते हुए अनुरोध करता है कि नई पौधा किस्म का रजिस्ट्रीकरण उसके नाम पर किया जाये;

और, उसने अपने आवेदन द्वारा और शपथ, उक्त पौधा किस्म के विशिष्ट विशिष्ट लक्षणों और उसके अभिदान का उल्लेख किया है;

अतः यह विलेख है कि उपर्युक्त आवेदक (जिसमें उसके विधिक प्रतिनिधि और प्रत्यायोजिती या उनमें से कोई भी) ही पौधा किस्म संरक्षण और कृषक अधिकार अधिनियम, 2001 के उपबंधों और उक्त अधिनियम की धारा 47 में विनिर्दिष्ट शर्तों और उपबंधों तथा किसी अन्य विधि द्वारा विनिर्दिष्ट शर्तों और उपबंधों के अधीन रहते हुए वर्ष 2024 के जून मास की 13 तारीख से 13 वर्षों की अवधि के लिए इस संबंध में लिए गए रजिस्ट्रीकरण के प्रयोजन, उक्त किस्म के उत्पादन, विक्रय, विपणन, वितरण, आयात या निर्यात करने और ऐसा करने के लिए किसी अन्य व्यक्ति को प्राधिकृत करने का अनन्य अधिकार होगा, इस शर्त के अधीन रहते हुए कि इस रजिस्ट्रीकरण की किसी वार्षिकी का संदाय नहीं की जाती है और इस रजिस्ट्रीकरण को बनाए रखने के लिए विहित फीस का समय-समय पर संदाय किया जाता है।

Whereas, Indian Council of Agricultural Research, Krishi Bhawan, New Delhi-110001, Delhi has declared that he has developed Co 09004 (Amritha) of Sugarcane (Saccharum L.) as New plant variety and that he is the true breeder thereof (or the legal representative or assignee of the true breeder) and that he is entitled to a plant variety right on the said variety, having regard to the provisions of the Protection of Plant Varieties and Farmers' Rights Act, 2001 and that there is no objection to the registration of plant variety in favor of him.

And whereas he has, by an application, requested that registration of New plant variety June be allowed to him for the said plant variety;

And whereas he has, by and in his application, particularly described the various distinctive features and mentioned the denomination of the said plant variety;

Now, these presents that the above said applicant (including his legal representatives and assignees or any of them) shall, subject to the provisions of the Protection of Plant Varieties and Farmers' Rights Act, 2001 and the conditions specified in section 47 of the said Act, and the conditions and provisions specified by any other law for the time being in force, from the 13th day of June, 2024, have the exclusive right to produce, sell, market, distribute, import or export the variety for initial term of Six years & renewable for the remaining years and of authorizing any other person to do so, subject to the conditions that the validity of this registration is not guaranteed and that the fee prescribed for the continuance of this registration are duly paid.

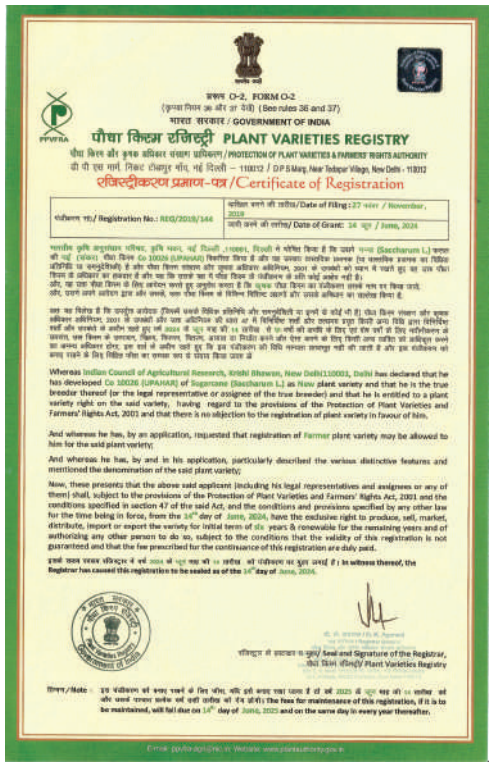
इसके साक्ष्य स्वरूप रजिस्ट्रार ने वर्ष 2024 के जून मास की 13 तारीख को रजिस्ट्रीकरण पर मुद्रा अंकाई है। In witness thereof, the Registrar has caused this registration to be sealed as of the 13th day of June, 2024.

रजिस्ट्रार के हस्ताक्षर व मुद्रा/ Seal and Signature of the Registrar, पौधा किस्म रजिस्ट्री/ Plant Varieties Registry

टिप्पण/Note : इस रजिस्ट्रीकरण को बनाए रखने के लिए फीस, यदि इसे बनाए रखा जाना है तो वर्ष 2025 के जून मास की 13 तारीख को और उसके पश्चात प्रत्येक वर्ष उसी तारीख को देय होगी। The fees for maintenance of this registration, if it is to be maintained, will fall due on 13th day of June, 2025 and on the same day in every year thereafter.

E-mail: ppvfra-agri@nic.in Website: www.plantauthority.gov.in

Registration certificate for Co 09004 from PPV&FRA



PPV&FRA

प्रपत्र O-2, FORM O-2

(नियम 36 और 37 देखें) (See rules 36 and 37)

भारत सरकार / GOVERNMENT OF INDIA

पौधा किस्म रजिस्ट्री PLANT VARIETIES REGISTRY

पौधा किस्म और कृषक अधिकार संरक्षण प्राधिकरण/PROTECTION OF PLANT VARIETIES & FARMERS' RIGHTS AUTHORITY

सी.पी.एस. मार्ग, निकट टोबाकुर गाँव, नई दिल्ली – 110012 / D.P.S Marg, Near Todapur Village, New Delhi - 110012

रजिस्ट्रीकरण प्रमाण-पत्र /Certificate of Registration

पंजीकरण सं./ Registration No.: REG/2018/144

पंजीकरण करने की तारीख/Date of Filing: 27 नवंबर / November, 2018

जारी करने की तारीख/ Date of Grant: 14 जून / June, 2024

भारतीय कृषि अनुसंधान परिषद्, कृषि भवन, नई दिल्ली-110001, दिल्ली ने घोषित किया है कि उसने गन्ना (Saccharum L.) प्रजाति की नई पौधा किस्म Co 10026 (UPAHAR) विकसित किया है और वह उसका पारंपरिक उत्पन्नकर्ता (या उसकानिधिक प्रतिनिधि या उत्तराधिकारी) है और पौधा किस्म संरक्षण और कृषक अधिकार अधिनियम, 2001 के उपबंधों को ध्यान में रखते हुए वह उस पौधा किस्म के अधिकार का हकदार है और यह कि उसको उस में पौधा किस्म के पंजीकरण के प्रति कोई आक्षेप नहीं है।

और, वह उक्त पौधा किस्म के लिए आवेदन करते हुए अनुरोध करता है कि नई पौधा किस्म का रजिस्ट्रीकरण उसके नाम पर किया जाये;

और, उसने अपने आवेदन द्वारा और शपथ, उक्त पौधा किस्म के विशिष्ट विशिष्ट लक्षणों और उसके अभिदान का उल्लेख किया है;

अतः यह विलेख है कि उपर्युक्त आवेदक (जिसमें उसके विधिक प्रतिनिधि और प्रत्यायोजिती या उनमें से कोई भी) ही पौधा किस्म संरक्षण और कृषक अधिकार अधिनियम, 2001 के उपबंधों और उक्त अधिनियम की धारा 47 में विनिर्दिष्ट शर्तों और उपबंधों तथा किसी अन्य विधि द्वारा विनिर्दिष्ट शर्तों और उपबंधों के अधीन रहते हुए वर्ष 2024 के जून मास की 14 तारीख से 13 वर्षों की अवधि के लिए इस संबंध में लिए गए रजिस्ट्रीकरण के प्रयोजन, उक्त किस्म के उत्पादन, विक्रय, विपणन, वितरण, आयात या निर्यात करने और ऐसा करने के लिए किसी अन्य व्यक्ति को प्राधिकृत करने का अनन्य अधिकार होगा, इस शर्त के अधीन रहते हुए कि इस रजिस्ट्रीकरण की किसी वार्षिकी का संदाय नहीं की जाती है और इस रजिस्ट्रीकरण को बनाए रखने के लिए विहित फीस का समय-समय पर संदाय किया जाता है।

Whereas Indian Council of Agricultural Research, Krishi Bhawan, New Delhi110001, Delhi has declared that he has developed Co 10026 (UPAHAR) of Sugarcane (Saccharum L.) as New plant variety and that he is the true breeder thereof (or the legal representative or assignee of the true breeder) and that he is entitled to a plant variety right on the said variety, having regard to the provisions of the Protection of Plant Varieties and Farmers' Rights Act, 2001 and that there is no objection to the registration of plant variety in favour of him.

And whereas he has, by an application, requested that registration of Farmer plant variety may be allowed to him for the said plant variety;

And whereas he has, by and in his application, particularly described the various distinctive features and mentioned the denomination of the said plant variety;

Now, these presents that the above said applicant (including his legal representatives and assignees or any of them) shall, subject to the provisions of the Protection of Plant Varieties and Farmers' Rights Act, 2001 and the conditions specified in section 47 of the said Act, and the conditions and provisions specified by any other law for the time being in force, from the 14th day of June, 2024, have the exclusive right to produce, sell, market, distribute, import or export the variety for initial term of six years & renewable for the remaining years and of authorizing any other person to do so, subject to the conditions that the validity of this registration is not guaranteed and that the fee prescribed for the continuance of this registration are duly paid.

इसके साक्ष्य स्वरूप रजिस्ट्रार ने वर्ष 2024 के जून मास की 14 तारीख को रजिस्ट्रीकरण पर मुद्रा अंकाई है। In witness thereof, the Registrar has caused this registration to be sealed as of the 14th day of June, 2024.

रजिस्ट्रार के हस्ताक्षर व मुद्रा/ Seal and Signature of the Registrar, पौधा किस्म रजिस्ट्री/ Plant Varieties Registry

टिप्पण/Note : इस रजिस्ट्रीकरण को बनाए रखने के लिए फीस, यदि इसे बनाए रखा जाना है तो वर्ष 2025 के जून मास की 14 तारीख को और उसके पश्चात प्रत्येक वर्ष उसी तारीख को देय होगी। The fees for maintenance of this registration, if it is to be maintained, will fall due on 14th day of June, 2025 and on the same day in every year thereafter.

E-mail: ppvfra-agri@nic.in Website: www.plantauthority.gov.in

Registration certificate for Co 10026 from PPV&FRA

Registration certificate for Co 15023 from PPV&FRA

Registration certificate for Co 11015 from PPV&FRA

Registration certificate for Co 12009 from PPV&FRA

पेटेंट कार्यालय भारत सरकार The Patent Office, Government Of India
पेटेंट प्रमाण पत्र | Patent Certificate

पेटेंट सं. / Patent No. : 516028
आवेदन सं. / Application No. : 3323/CHE/2011
फाइल करने की तारीख / Date of Filing : 26/09/2011
पेटेंटी / Patentee : INDIAN COUNCIL OF AGRICULTURAL RESEARCH

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित *RAPID TREATMENT FOR PLANTING MATERIALS OF SUGARCANE AND OTHER VEGETATIVELY PROPAGATED CROPS* नामक अविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख सितम्बर 2011 के छब्बीसवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled *RAPID TREATMENT FOR PLANTING MATERIALS OF SUGARCANE AND OTHER VEGETATIVELY PROPAGATED CROPS* as disclosed in the above mentioned application for the term of 20 years from the 26th day of September 2011 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख / Date of Grant : 27/02/2024

Controller of Patents

Note. – This fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 26th day of September 2012 and on the same day in every year thereafter.

Granted patent certificate, No.: 516028, Rapid treatment for planting materials of sugarcane and other vegetatively propagated crops

पेटेंट कार्यालय भारत सरकार The Patent Office, Government Of India
पेटेंट प्रमाण पत्र | Patent Certificate

पेटेंट सं. / Patent No. : 526939
आवेदन सं. / Application No. : 5384/CHE/2013
फाइल करने की तारीख / Date of Filing : 21/11/2013
पेटेंटी / Patentee : INDIAN COUNCIL OF AGRICULTURAL RESEARCH

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित *VACUOLAR TARGETING DETERMINANTS FOR PLANTS AND USES THEREOF* नामक अविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख नवम्बर 2013 के इक्कीसवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled *VACUOLAR TARGETING DETERMINANTS FOR PLANTS AND USES THEREOF* as disclosed in the above mentioned application for the term of 20 years from the 21st day of November 2013 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख / Date of Grant : 15/03/2024

Controller of Patents

Note. – This fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 21st day of November 2015 and on the same day in every year thereafter.

Granted Patent certificate No.: 526939 for Vacuolar targeting determinants for plants and uses thereof

पेटेंट कार्यालय, भारत सरकार The Patent Office, Government Of India
डिजाइन के पंजीकरण का प्रमाण पत्र | Certificate of Registration of Design

डिजाइन सं. / Design No. : 396729-001
तारीख / Date : 05/10/2023
पारस्परिकता तारीख / Reciprocity Date* :
देश / Country :

प्रमाणित किया जाता है कि संलग्न प्रति में वर्णित डिजाइन जो *PARASITOID RELEASE STATION* से संबंधित है, का पंजीकरण, वर्ग 22-06 में Indian Council Of Agricultural Research के नाम में उपर्युक्त संख्या और तारीख में कर लिया गया है।

Certified that the design of which a copy is annexed hereto has been registered as of the number and date given above in class 22-06 in respect of the application of such design to *PARASITOID RELEASE STATION* in the name of Indian Council Of Agricultural Research.

डिजाइन अधिनियम, 2000 तथा डिजाइन नियम, 2001 के अध्यधीन प्रावधानों के अनुसरण में।
In pursuance of and subject to the provisions of the Designs Act, 2000 and the Designs Rules, 2001.

Date of Issue : 13/06/2024

Controller General of Patents, Designs and Trade Marks

Granted design certificate, No. 396729-001 for Parasitoid release station for pest control

Licensed ICAR-SBI EPN biopesticide formulation to Bannari Amman Sugars Ltd, Erode, Tamil Nadu (11-03-2024)

Licensed ICAR-SBI EPN biopesticide formulation to Bharti Green tech, Satara, Maharashtra

Licensed ICAR-SBI EPN biopesticide formulation to Ecobugs India private Limited, Thanjavur, Tamil Nadu

Licensed CANEJAM technology to Shree Pancham Shivalingeshwar Jaggery and Agriculture Products, Karnataka

Licensed the technology ICAR CIAE SBI EPN applicator to GREENFIELD EQUIPMENT (I) PVT LTD, Coimbatore, Tamil Nadu

Licensed the ICAR-SBI-CIAE Sett Treatment Device technology to CLEANTEK, Coimbatore, Tamil Nadu

Licensed the Cotesia flavipes and Telnomus dignus multiplication technology against internode borer with field release station to E.I.D. - PARRY (India) Limited, Karur, Tamil Nadu

Licensed the Cotesia flavipes and Telnomus dignus multiplication technology against internode borer with release station to Bannari Amman Sugars Limited, Erode, Tamil Nadu

Licensed the Standardized liquid jaggery process technology to Panaivi Naturals, Tirupur, Tamil Nadu

Licensed the Standardized liquid jaggery process technology to Kalai Exim, Dindivanam, Tamil Nadu

Licensed the Standardized liquid jaggery process technology to JK Foods, Shivamogga, Karnataka

Licensed the SBIEC14006 - An Energycane with High biomass production to Hriday Hydrogen Revolution Forum, Mumbai, Maharashtra

13

Meetings, Workshops & Events Organized

Republic Day celebration

Republic Day was celebrated on 26 January 2024. Dr. G. Hemaprabha, Director of the Institute hoisted the National flag and addressed the staff.

Republic Day Celebrations

National Science day

ICAR-SBI celebrated the 'National Science Day' as an 'open- day' on 28 February 2024 in the Institute premises on the theme "Indigenous Technologies for Viksit Bharat" in order to inculcate scientific awareness in the minds of the students. Dr. N. Vijayan Nair, former Director of ICAR-SBI and Guest of Honor, delivered the Science Day lecture entitled, 'On the grass trail'.

National Science Day Exhibition

International Women's day

International Women's Day was celebrated on 08 March 2024

International Women's Day

Inauguration of institute facilities

- Ex-*situ* facility for conservation of wild sugarcane germplasm in the Additional land, "VIP Suite Room" in the Scientist Home and two mobile sale units at ICAR-SBI were formally inaugurated by Dr. T.R. Sharma, DDG CS on 01 April 2024.
- Sir T.S. Venkataraman *Sumadhuram* Hall of the institute with a seating capacity of 250 members, was formally inaugurated by Secretary, DARE and Director General, ICAR, Dr. Himanshu Pathak on 11 July 2024.

DG, ICAR inaugurating Sir TS Venkataraman Sumadhurum Hall

- Micro-plots (48 Nos.) with rainout shelter of Plant Physiology at ICAR-SBI, Regional Centre, Karnal was formally inaugurated by Dr. T.R. Sharma, DDG (Crop Science), ICAR, New Delhi on 24 July 2024 under RKVY, Haryana project.

Inauguration of rainout shelter facility at SBIRC Karnal

World Intellectual Property day

A lecture on "Role of AI and IoT in Agriculture and its scope in Intellectual Property Management" by Dr. S.V. Sudha, Professor & HOD, Department of Artificial Intelligence and Data Science, KPR Institute of Engineering and Technology, Coimbatore was jointly organized by ITMU and ABI of ICAR-SBI, Coimbatore on the eve of World Intellectual Property (WIP) Day on 30 April 2024.

Field day and Seed day

- Seed Day was celebrated on 20 March 2024 with Seed farmers and all scientists of the Institute. Field day and Seed Day (on Co 14012 and Co 18009) of the institute was organized by AICRP on seed crops (Sugarcane) at Ramayampalayam, Vaiyapurikovundanputhur and Alagathiripalayam, Tiruppur district on 30 January, 2024.
- Field Day of sugarcane variety "Co 11015" was organized in a Frontline Demonstration field in Rajanthangal, Thiruvannamalai District on 28 June 2024.
- A 'Field Day' of the newly released sugarcane variety, 'Co 14012' was organized by ICAR-Sugarcane Breeding Institute (ICAR-SBI), Coimbatore in association with Sakthi Sugars Ltd. Appakudal in Mathur village, Anthiyur, Erode on 17 December 2024. On this occasion, farmers witnessed crop's performance and received seed material.

International Yoga day

10th International Yoga Day was celebrated at the Institute on 21 June 2024.

Brainstorming session

A Brain Storming session cum training on "Sustainable sugarcane farming in subtropical India: The seed of prosperity from glorious past to challenging future" was organized at ICAR- Sugarcane Breeding Institute,

Regional Centre, Karnal (Haryana) on 24 July 2024 under the chairmanship of Dr. T. R. Sharma, DDG (Crop Science), ICAR, New Delhi.

Viksit Bharat Sankalp Yatra

ICAR-SBI joined in the nationwide campaign "Viksit Bharat Sankalp Yatra" by nominating a team of 46 members from the Institute to raise awareness among farmers of districts of Tamil Nadu *viz.*, Sivagangai, Villupuram, Tiruppur, Virudhunagar and Tiruvannamalai on the activities and technologies developed by the Institute in coordination with the concerned KVKs of the district during the specified period respectively, from 15 November 2023 to 26 January 2024. During the National Science Day celebration, staff of the institute deputed for Viksit Bharat Sankalp Yatra were felicitated.

Hon'ble Union Minister of State at Viksit Bharat Sankalp Yatra campaign

A country-wide mass pledge against Drugs with the theme "Viksit Bharat ka Mantra, Bharat ho Nashe se Swatantra" was taken by the staff of the institute on 14 August 2024 at the Institute in connection with 78th Independence Day and for the occasion of NMBA entering its 5th year since the launch.

Independence day celebration

Independence Day was celebrated in the Institute on 15 August 2024. Dr. P. Govindaraj, Director, ICAR-SBI hoisted the national flag and addressed the staff.

Independence Day Celebrations

Hindi Day celebration

To commemorate the adoption of Hindi as Official language, Hindi Day was celebrated on 19 September 2024 at the institute.

Seminar/Lectures

- Webinar on "Managing Genetic Resources in Crop Improvement" was organized by SSRD in collaboration with ICAR-SBI and NAAS Chapter (Coimbatore) on 25 January 2024.
- Technical seminar on 'Current challenges in sugarcane agriculture and Mechanization & Machine learning for smart agriculture' on 09 July 2024 at the Institute. Lead talks were delivered by Dr. Bakshi Ram, Dr. Prasanta Kumar Dash, ADG (CC) and Sh. Ashok Kumar (General Manager, Sakthi Sugars Ltd).
- An online lecture on "Applying Copyright for Publications" by Dr. Anupam Barh Scientist, ICAR-IISWC was organized on 29 August 2024 at the Institute.
- A special lecture on "Waste Management & Pro-Sustainability Behaviour" by Mrs. Senofia, Green Era firm, Coimbatore was organized for all staff and labourers working in the Lab on 10 October 2024.

Workshop

- One day workshop on "Emerging Issues in Sugarcane Agriculture in Tamil Nadu" was organized on 6 February 2024 under the collaborative project between ICAR-SBI and SISMA, Tamil Nadu.
- A workshop on "Climate resilient Sugarcane Agriculture for Greener and Sweeter Tomorrow" was organized on 24 April 2024 for Mission LIFE (Lifestyle for Environment) aligned with the World Environment Day 2024.
- Organized the 22nd Sugarcane Research & Development Workshop of Southern Karnataka at B.N. Bahadur Institute of Management Sciences, Manasagangothri, University of Mysore, Mysuru, during 20-21 June 2024.
- Organized the ISSCT 13th Breeding and Germplasm and 10th Molecular Biology Workshop from 8-12, July 2024. A total of 82 delegates including 39 Scientists from France, Reunion, Barbados, USA, South Africa, Australia, Thailand, Japan, Brazil, Indonesia, Argentine, Zimbabwe

and Fiji participated in the workshop. Altogether, 35 Scientists attended from the Institute.

Farm School on AIR (FSA)

ICAR-SBI had launched a 'Farm School on AIR (FSA)' on 'Sugarcane farming for prosperity' (வளமான வாழ்விற்கு கரும்பு சாகுபடி) in Tamil for the benefit of the farmers to gain the latest technical knowledge and information on scientific sugarcane cultivation in collaboration with Akashwani, Coimbatore.

Farm School on AIR (FSA)

World Environment day

- On the occasion of World Environment Day 2024, all staff of the Institute participated in the Global Campaign #Plant4Mother and planted saplings of different kinds of trees for protecting and preserving our Mother Earth on 11 September 2024.

Swachhta Hi Sewa

- ICAR-SBI observed *'Swachhta Hi Sewa'* campaign from the second fortnight of September 2024 to 02 October 2024. To start with, Swachhta Pledge was taken by the all staff of the Institute on 13 September 2024. All the staff participated in 'Swachhta Walk by the Lake' scheduled on 16 September 2024. Organized a drawing completion on the theme 'Clean India Green India' for the children of the staff (age below 12 years) on 18 September 2024.
- Swachhta Pakhwada – 2024 at ICAR-SBIRC, Karnal was initiated on 17 September 2024 with Swachhta oath taken by staff members followed by plantation done under the campaign "Ek Ped Maa Ke Naam".

'Swachhta Hi Sewa' campaign

Institute Foundation day

- Institute's 113th Foundation Day was celebrated on 25 October 2024. Dr Major Singh, Member (Plant Science), Agricultural Scientists Recruitment Board, New Delhi, was the Chief Guest and Dr. R. Viswanathan, Director, ICAR-IISR, Lucknow and Dr. V. Venkatasubramanian, Director, ICAR-ATARI, Bengaluru were the Guests of honour of the function.

113th Foundation Day of ICAR-SBI

World Soil day

- World Soil Day 2024 was celebrated at the Institute on 29 November 2024. On this occasion, all the Scientists, SRFs, YPs and students participated in the special lecture delivered by Dr G. Byju, Director, ICAR-CTCRI, Thiruvananthapuram on "Role of Plant Nutrition in Food Security - Achievements, Aspirations and Action Plan".
- World Soil Day 2024 was organized for sugarcane farmers at Ponni Sugars (Erode) Ltd., Erode, on 05 December 2024. A drawing Competition was

conducted for Ponni Nursery and Primary School students in Odappalli, Erode on 03 December 2024.

World Soil Day Lecture

Vigilance Awareness Week

Vigilance Awareness Week was observed at the Institute from 28 October 2024 to 3 November 2024 and a Pledge taking ceremony was organized on 28 October 2024. Essay and Quiz competitions were also conducted for staff members/SRF/JRF/YPs/Prj. Asst./Ph.D scholars Shri. C. Mohan Gobu, I.R.S., Additional Commissioner, Coimbatore delivered a talk on 'Preventive Vigilance'.

Vigilance Awareness Talk

Meetings

- 13th Annual General Body meeting (AGM) of the Society for Sugarcane Research and Development (SSRD) was organized on 12 November, 2024 at ICAR-SBI, Coimbatore, Tamil Nadu
- IBSC Meeting was held at the Institute on 18 July 2024.

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Committees

Institute Research Committee Meeting

Institute Research Committee Meeting for the year 2024 was held at the Institute during 23-27 September and 1 October 2024 to review the progress of ongoing research projects and finalise the Technical Programme for the year 2024.

Institute Research Committee Meeting in progress

Institute Management Committee Meeting

The 101st Meeting of the Management Committee of the ICAR-Sugarcane Breeding Institute was held on 6 March 2024.

Research Advisory Committee Meeting

The XXX Research Advisory Committee meeting commenced on 25.07.2024 at SBI-RC, Karnal under the Chairmanship of Prof. S.K. Sharma, Former Vice Chancellor, CSK Himachal Pradesh Agricultural University, Palampur. Dr. B.L. Jalali, Dr. A.R. Sharma, Dr. R. Srinivasan, Dr. S.S. Singh, Dr. J. Singh and Dr. Prasanta K. Dash, ADG (Commercial Crops) were the expert members present in the meeting. Director, ICAR-SBI; Director, ICAR-IISR, Lucknow, all Head of the Divisions, Heads of Extension, Economics sections and other Heads of regional stations attended the meeting. All the scientists of ICAR-SBI and the Office In-charge, SBIRC, Kannur participated by virtual mode.

RAC in progress

Chairman and members of RAC at SBIRC, Karnal

Recommendations of RAC

Crop Improvement

1. Core and mini-core collection of commercial canes may be developed for effective utilization of genetic resources. Multi-trait genetic stocks may be identified combining few economically important traits, including multi-ratooning ability for developing multi-ratooning varieties for cultivation.
2. Genomic approaches involving contrasting genotypes to look for differentially expressed genes for traits of interest to be strengthened and SNPs identified for red rot resistance should be validated for further utilization in breeding programme.
3. Waterlogging is an emerging abiotic stress which limits the sugarcane productivity. Germplasm and genetic stocks need to be screened for this trait. Natural waterlogging conditions prevalent in Bihar State may be utilised for screening purposes.
4. Sugarcane should be a partner in CRP on Agro-biodiversity network program and the same may be discussed with the Director, ICAR-NBPGR.

Crop Production

1. There is a need to develop and adopt labour-neutral technologies by going for near-complete mechanization in sugarcane cultivation.
2. Drone-based spraying of micronutrients and pesticides has been initiated, and found to show large savings in time and money. However, the effects on crop productivity and drift hazards need to be evaluated critically.
3. Some microbes have been found promising for improving productivity like PGPR, biofertilizers, biocontrol agents and sugarcane biomass-digesting microbes. It is desirable that such leads are carried forward and established for technology generation.
5. There have been some success stories on long-term ratooning of sugarcane (32 cycles) and 100% mechanical harvesting of sugarcane in collaboration with sugar industry. A document on such stories with research-based data on productivity and economics should be prepared.

Crop Protection

1. The dynamics on important pathogens causing red rot, wilt, and Pokkah Boeng should be continuously monitored. Status update of Pokkah Boeng along with crown mealy bug under different agro-climatic conditions and also drone-based disease management strategies for major diseases considering leaf wetness and sunlight intensity should be prepared in sugarcane.
2. More intensified efforts on red rot involving ICAR-SBI and ICAR-IISR to understand breakdown of disease resistance and multi-prong strategies to be attempted to decipher red rot resistance using molecular platforms.
3. Domestic and International Quarantine should be strengthened to regulate movement of seed cane and more emphasis should be given on establishment of healthy seed nursery program.

General

1. Feedback from stakeholders to prioritize researchable issues, training needs of stakeholders to be identified and custom-made training programs are to be conducted for the benefit of farmers and cane industry personnel.
2. FSSAI certificates should be made mandatory for the Incubatees under ABI. Extension group should work together with breeders to spread the popularity of varieties across the country.

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Participation in Conferences, Meetings, Workshops, Symposia & Seminars

S.No	Title	Date	Participant(s)
1.	Diamond jubilee celebration of NAAS accredited Autonomous College at Kochi	5 January 2024	Dr. G. Hemaprabha
2.	Technical committee meeting to evaluate the technical specifications of the Data logger with sensors and continuous soil parameters monitoring systems held at TNAU, Coimbatore	10 January 2024	Dr. K. Hari
3.	3rd International Conference and Exhibition on the theme "Sustainability: Challenges & Opportunities in Global Sugar Industry" held at VSI Campus, Pune	12-14 January 2024	Dr. G. Hemaprabha, Dr. P. Malathi, Dr. T. Rajula Shanthy, Dr. C. Appunu, Dr. V. Sreenivasa and Dr. S. Anusha
4.	Review meeting of eHRMS-2.0 (online) organized under the chairmanship of ADG (ICT) ICAR	16 January 2024	Dr. M.L. Chhabra
5.	SRIJAN: Empowering ZTMCs/ ITMUs held at NAAS Complex New Delhi by ICAR IPTM Unit	17-19 January 2024	Dr. B. Singaravelu
6.	Zonal Breeders and Plant Protection Scientist Meet – 2024 of AICRP on Sugarcane through online organized by ICAR-IISR, Lucknow	19 January 2024	All Breeders and Pathologists and Heads of the Divisions of the Institute
7.	One-day seminar on "Managing Genetic Resources in Crop Improvement", organized by NAAS-Coimbatore chapter, ICAR-SBI, and SSRD	25 January 2024	All scientists

S.No	Title	Date	Participant(s)
8.	Annual Group Meeting of AICRP on Integrated Farming Systems" at Indira Gandhi Vishwa Vidhyalaya, Raipur (Chhattisgarh)	30-31 January 2024	Dr. P. Geetha
9.	National symposium on 'Nematodes: The Unseen Foes and Friends of Plant and Soil Health" held at Kolkata, organized by Nematological Society of India & Indian Statistical Institute at Kolkata.	31 January-2 February 2024	Dr. C. Sankaranarayanan
10.	National Conference on "Plant Health for Food Security – Threats and promises" held at ICAR-IISR, Lucknow	1-3 February 2024	Dr. A. Anna Durai Dr. P. Malathi Dr. S. Alarmelu Dr. K. Mohanraj Dr. R. Gopi Dr. K. Nithya and Dr. H.K. Mahadeva Swamy
11.	Review meeting of SISMA Sweet Bloom project	06 February 2024	The Director, Heads of Divisions /R&D Heads/Chairman /MD of the Member mills
12.	Meeting of the Board of Studies, ICAR-IARI Mega University Karnal Hub at ICAR-IIWBR, Karnal.	07 February 2024	Dr. M. L. Chhabra and Dr. Ravinder Kumar
13.	International Day of Women and girls in science at NGP-iTech as an invited guest and delivered a talk	09 February 2024	Dr. P.T. Prathima
14.	SWATI – Science for Women-A Technology & Innovation Portal organized by Indian Academy Panel (IAP) on Women in Science, Technology, Engineering, Mathematics & Medicine (STEMM) in collaboration with DBT National Institute of Plant Genome Research, New Delhi	11 February 2024	Dr. R. Manimekalai
15.	International Conference on New Horizons in Bioengineering: Fostering Academia – Industry Partnership (ICB-2024) organized by School of Bioengineering, SRM Institute of Science and Technology	14-16 February 2024	Dr. C. Appunu
16.	28th Regional Committee Meeting of Zone VIII held in Chennai	16 February 2024	Dr. G. Hemaprabha and Dr. C. Palaniswami

S.No	Title	Date	Participant(s)
17.	Workshop on "Targeting Energy Crops: Food - Energy Nexus" held at Tamil Nadu Agricultural University, Coimbatore	22 February 2024	Dr. G. Hemaprabha
18.	41st IMC Meeting of Central Citrus Research Institute through online	1 March 2024	Dr. R. Manimekalai
19.	Meeting in connection with Velaan Thiruvizha (Krishi Mahotsav) organized by Jain Irrigation Systems Ltd., at Elayamuthur, Udumalpet	5 March 2024	Dr. G. Hemaprabha, Dr. C. Palaniswami and Dr. T. Arumuganathan
20.	All India Seminar on "Mechanisation of Sugarcane farming: Operational, Environmental and Policy constraints" organized by the Sugar Technologies Association of India (STAI), New Delhi at ICAR-IISR, Lucknow	7 March 2024	Dr. T. Arumuganathan
21.	Annual Group meet of Networking Project on "Improving water use efficiency and economizing water use in sugarcane cultivation in India (ISMA) at ISMA Office, New Delhi	10 March 2024	Dr. P. Geetha
22.	17th Scientific Advisory Committee (SAC) meeting of KVK, Kannur	11 March 2024	Dr. M. Nisha
23.	Online SSR Workshop entitled "Grooming the next Generation scholars in carbon Dynamic Research funded by DST	11 March 2024	Dr. K. Kannan
24.	Online Review Meeting on "Sugarcane MLT&ART" conducted by Tamil Nadu Agricultural University, Coimbatore	11 March 2024	Dr. A. Anna Durai
25.	ITC/FAO workshop on "Cultivating Tomorrow: Advancing digital agriculture through IoT and AI" organized by FAO and ICAR held in New Delhi	18-20 March 2024	Dr. K. Kannan
26.	"Finger millet germplasm field day" held at TNAU chaired by Dr. T.R . Sharma, DDG(CS)	1 April 2024	Dr. G. Hemaprabha
27.	Review meeting on achievements made under AAP of NFSM CC during 2023-24	10 April 2024	Dr. G. Hemaprabha, Dr. P. Malathi and Dr. D. Neelamathi
28.	International conference on Advances in Plant Biology – from genome editing to sustainable development at Inst. of Biotechnology, Vietnam.	11-13 April 2024	Dr. R. Manimekalai

S.No	Title	Date	Participant(s)
29.	Online meeting on "World Intellectual Property Day"	26 April 2024	All scientists
30.	Online Meeting of ICAR-DARE, on Viksit Bharat (Horticulture Crops)	01 May 2024.	All scientists
31.	27th Annual Breeder Review Meeting and 39th Annual Group Meeting of AICRP on seed (Crops) at University of Agricultural Sciences, Bengaluru	2-3 May 2024	Dr. S. Karthikeyan
32.	Online meeting on Ecoregional working group presentation for pulses and oilseeds by DDG (CS), ICAR	10 May 2024	Dr. G. Hemaprabha and all scientists
33.	Meeting organized by the Principal Scientific Advisor to Prime Minister on 'Biomass to Bioenergy-Path Forward" held in New Delhi;	14 May 2024	Dr. P. Govindaraj
34.	Interaction meeting of VCs of SAUs and Secretary (A&FW) at Krishi Bhavan, New Delhi scheduled to discuss DSMS smart irrigation device.	14 May 2024	Dr. K. Hari
35.	Online Meeting by Agrinnovate India w.r.t. Supply of Sugarcane Varieties from India to GUYSUCO GUYANA through Ministry of Agriculture, Guyana	16 May 2024	Dr. G. Hemaprabha and Dr. K. Hari
36.	Meeting at ICAR-ATARI, Bengaluru, to discuss organizing FLDs and collaborative tribal development initiatives	21 May 2024	Dr. D. Puthira Prathap
37.	52nd meeting of Plant Germplasm Registration Committee (PGRC) held through virtual mode	22 May 2024	Dr. G. Hemaprabha
38.	12th International symposium of the International Society of Root Research: Roots (&/Roads) to a sustainable future at Leipzig, Germany.	02-07 June 2024	Dr. V. Krishnapriya
39.	31st Annual General Body Meeting and Foundation Day Programme of the National Academy of Agricultural Sciences (NAAS) held in NASC Complex, New Delhi	4-5 June 2024	Dr. G. Hemaprabha and Dr. A. Ramesh Sundar
40.	Seminar on "Sugarcane Production Technology" in Sathyamangalam organized by Bannari Amman Sugars Ltd., Sathyamangalam	05 June 2024	Dr. C. Palaniswami, Dr. P. Malathi, Dr. P. Mahesh and Dr. C. Sankaranarayanan

S.No	Title	Date	Participant(s)
41.	Review Meeting on ICAR Institutes held online.	07 June 2024, 11 June 2024, 13 June 2024 & 14 June 2024	Dr. G. Hemaprabha
42.	79th half yearly review meeting of TOLIC at ICAR- NDRI, Karnal	12 June 2024	Dr. M.L. Chhabra, Dr. Ravinder Kumar and Mr. Parmod Kumar
43.	33rd Annual Group Meeting of AICRP on Biological Control at Dr. Y.S Parmer University of Horticulture and Forestry, Nola, Chandigarh	13-14 June 2024	Dr. T. Ramasubramanian
44.	Meeting of Board of Directors of Sugarfed, Punjab in Chandigarh	19 June 2024	Dr. M.L. Chhabra
45.	Workshop on sugar and Bioenergy as a part of 64th ISO Council Meeting held at New Delhi	25 June 2024	Dr. G. Hemaprabha
46.	Technical Seminar on Current challenges in sugarcane agriculture and mechanization and machine learning for smart agriculture at ICAR-Sugarcane Breeding Institute	09 July 2024	All scientists
47.	ISSCT 13th Germplasm and Breeding/10th Molecular Biology Workshop held at Coimbatore	8-12 July 2024	Dr. G.Hemaprabh; Dr. P. Govindaraj, Dr. R.Valarmathi, Dr. C. Appunu, Dr. V.P. Sobhakumari, Dr. G.S. Suresha, Dr. K. Devakumar, Dr. R. Arun Kumar, Ms. Adhini S. Pazhany, Dr. S. Karthigeyan, Dr. H.K. Mahadeva Swamy, Dr. M. Nisha, Dr. R. Gopi, Dr. K. Lakshmi, Dr. S. Sheelamary, Dr. A. Ramesh sundar, Dr. R. Gomathi, Dr. Pooja Dhansu, Dr. Ravinder Kumar, Dr. P.T. Prathima, Dr. K. Mohanraj, Dr. R.M. Shanthi, Dr. R. Manimekalai, Dr. S. Alarmelu, Dr. B. Singaravelu, Dr. D. Puthira Prathap, Dr. P. Geetha, Dr. K. Elayaraja, Dr. P. Mahesh, Dr. A. Selvi, Dr. A. Suganya, Dr. P. Malathi and Dr. A. Anna Durai
48.	96th ICAR Foundation and Technology Day at NASC Complex, New Delhi to make #OneICAR as top trending in X.	16 July 2024	Dr. G. Hemaprabha, Dr M.L. Chhabra and Dr. M.R. Meena (Scientists and other staff of the Institute attended online)

S.No	Title	Date	Participant(s)
49.	Workshop on "Dynamic role of fertilizer control order in framing the fertilizer policy for balanced use of nutrients" organized by Fertiliser Association of India (FAI) as	16 July 2024	Dr. V. Kasthuri Thilagam and Dr. S. Anusha
50.	22nd Sugarcane Research & Development Workshop of Southern Karnataka held at Rani Bahadur Auditorium, Univ. of Mysore, Mysuru, organized during 20-21 June 2024		Dr. G. Hemaprabha, Dr. P. Govindaraj, Dr. K. Kannan, Dr. C. Palaniswami, Dr. C. Sankaranarayanan, Dr. S. Karthigeyan and Dr. D. Puthira Prathap
51.	e-HRMS Regional workshop at ICAR-ICPRI, Shimla on	24 June 2024	Dr. M. L. Chhabra
52.	82nd STAI Annual Convention and International Expo organized by Sugar Technologists Association of India (STAI) held at Jaipur	30-31 July 2024	Dr. R. Gomathi and Dr. M.R. Meena
53.	92nd meeting of the Central Sub-Committee on Crop standards, Notification and Release varieties for Agricultural Crops held under the Chairmanship of DDG (CS) through video conferencing.	02 August 2024	Director & all scientists
54.	International Conference of Agricultural Economists (ICAE) held in New Delhi	2-7 August 2024	Dr. P. Murali
55.	SLSC meeting of RKVY, Haryana (online).	06 August 2024	Dr. M.L. Chhabra and Dr. M.R. Meena
56.	IPR Awareness/Training programme under National Intellectual Property Awareness Mission organized by Intellectual Property Office, India.	9th August 2024	Dr. Vinayaka and Dr. Shweta kumari
57.	Online IP Awareness Seminar: Lab to Market: Leveraging IP, organized by ICAR-National Research Centre for Grapes	9 August 2024	Dr. R. Selvakumar
58.	53rd "Annual Convention of SISSTA" held at Whitefield, Bengaluru	19-20 August 2024	Dr. P. Malathi
59.	ICAR sponsored International conference on "Current innovations and technological advances in agriculture and allied sciences" organized by ISASTR – Indian Society of Agrl. Science and Tech. Research held in Punjab.	29-31 August 2024	Dr. M. Punithavalli

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60.	National level Stakeholders Meet for Sugarcane Farmers organized by Celebrating Farmers Edge International Private Ltd., Nashik, Maharashtra.	1-2 September 2024	Dr. P. Murali
61.	Online Stakeholder's Consultation Meet with the theme "Transforming Agriculture Research (TAR)-Enhancing role of private sector"	03 September 2024	Director, Heads of Divisions and Sections and four progressive farmers
62.	Online IPR awareness workshop on "Harnessing the power of Intellectual Property Rights" held organized by ICAR-IIMR	11 September 2024	Dr. V. Jayakumar, Dr. P. Mahesh, Dr. V. Krishnapriya and Dr. Kona Parveen
63.	8th IAPSIT International Sugar Conference (ISC 2024) & SugarCon 2024 jointly organized by International of Association Professionals in Sugar & Integrated Technologies (IAPSIT), Society for Sugar Research & Promotion (SSRP) and International Centre for Interdisciplinary Science & Education (ICISE) held at Quy Nhon, Vietnam	16-19 September 2024	Dr. S. Alarmelu, Dr. A. Suganya, Dr. R. Gomathi, Dr. R. Manimekalai and Dr. P. Murali (online),
64.	Launching ceremony of NAAS-YUVA chaired by President NAAS – Secretary (DARE) & DG-ICAR, organized by National Academy of Agricultural Sciences (online)	25 September 2024	All Scientists
65.	KVK Golden Jubilee Torch relay ceremony at Vadapudur village of Kinathudadavu block in Coimbatore district	4 October 2024	Dr. A. Anna Durai
66.	Workshop on "Agribusiness entrepreneurship for persons with disabilities (virtual session)" organized by Asian Productivity organization hosted by the National productivity centre of Cambodia	8-10 October 2024	Dr. P. Murali
67.	Hands-on training on 'Genomic selection: Principles and Methods' organizing by Tamil Nadu Agricultural University, Coimbatore in collaboration with International Rice Research Institute, Philippines at Coimbatore, Tamil Nadu.	14-18 October 2024	Dr. Shweta Kumari
68.	32nd National Conference on "Soil, Water and Energy Management for Sustainable Agriculture and Livelihood Security" held in Chandra Shekhar Azad University of Agriculture &Technology, Kanpur.	18-20 October 2024	Dr. V. Kasthuri Thilagam

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69.	ISMA meeting with the participation of sugar mills of subtropical region under ISMA trials at ICAR-SBIRC, Karnal	19 October 2024	Dr. P. Govindaraj, Dr. M.L Chhabra, Dr. Ravinder Kumar, Dr. K. Mohanraj, Dr. M.R. Meena and Dr. D. Pooja
70.	35th Biennial Workshop of AICRP on Sugarcane scheduled at Punjab Agricultural University, Ludhiana, Punjab	21-22 October 2024	Dr. P. Govindaraj, Dr. A. Ramesh Sundar, Dr. K. Kannan, Dr. R.M. Shanthi, Dr. T. Ramasubramanian, Dr. A. Anna Durai, Dr. R. Karuppaiyan, Dr. M.L. Chhabra, Dr. Ravinder Kumar, Dr. M.R. Meena, Dr. P. Geetha and Dr. P. Mahesh
71.	Webinar Expert talk on "Viksit Bharat @ Agriculture" delivered by Dr. Himanshu Pathak, Hon'ble Secretary DARE and DG, ICAR through online mode.	24 October 2024	All Scientists of the Institute
72.	Interactive session with Dr. Major Singh, Member (Plant Science), ASRB, New Delhi	25 October 2024	All Scientists of the Institute
73.	Online meeting with Cane Commissioner of State Governments and other stakeholders regarding Sugarcane Price Policy 2025-26 sugar season	25 October 2024	Dr. P. Govindaraj and Dr. P. Murali
74.	Online training programme on R for Bioinformatics organized by BIG facility, ICAR-Indian institute of spices research, Kozhikode, Kerala	4-8 November 2024	Dr. Kona Praveen
75.	Online meeting with Kibos Sugars Kenya hosted organized by Agrinnovate India regarding import license for new sugarcane varieties from ICAR-SBI	11 November 2024	Dr. P. Govindaraj
76.	13th Annual General Body meeting (AGM) of the Society for Sugarcane Research and Development (SSRD) held on at ICAR-SBI, Coimbatore, Tamil Nadu	12 November 2024	SSRD Office - bearers and members
77.	Workshop on Management of crown mealy bug and pokkah boeng in sugarcane conducted by ICAR-SBI in association with SSRD	12 November 2024	Nominated Scientists
78.	80th Six monthly TOLIC (Hindi) meeting at ICAR- NDRI, Karnal	18 November 2024	Dr. M.L. Chhabra, Dr. Ravinder kumar and Mr. Parmod Kumar

S.No	Title	Date	Participant(s)
79.	X International Scientific and Practical Conference on Biotechnology as an Instrument for Plant Biodiversity Conservation (physiological, biochemical, embryological, genetic, and legal aspects) at NASC Complex, New Delhi, India	19-21 November 2024	Dr. M. Nisha
80.	25th Group meeting of All India Network Project on Soil Arthropods at UAS, GKVK, Bengaluru	19-20 November 2024	Dr C. Sankaranarayanan and Dr. B. Singaravelu
81.	International Conference on "Unleashing the power of seed and crop health innovations for a food secure world ICUCF 2024" held at Tamil Nadu Agricultural University, Coimbatore.	21-22 November 2024	Dr. P. Malathi, Dr. M. Punithavalli and Dr. T. Ramsubramanian
82.	Field Day organized by Jain Irrigation Systems Ltd., at Udumalpet	22 November 2024	Dr. D. Puthira Prathap and Dr. V. Kasthuri Thilagam
83.	One-day workshop on "National brain storming workshop on formalization of seed system in tropical tuber" through online mode organized by ICAR-CTCRI, Thiruvananthapuram.	03 December 2024	Dr. D. Neelamathi
84.	Training cum workshop on "Drone Technology and its application in agriculture (Online) jointly organized by ICAR-IIWM & ICAR-IARI	01-03 December 2024	Dr. S. Anusha
85.	Joint meeting with officials of ICAR-KVK, Palakkad at SBIRC, Agali in connection with organizing a tribal campaign in association with ATARI, Bengaluru.	6 December 2024	Dr. D. Puthira Prathap
86.	32nd Annual Conference on "Digitalization of Agriculture for higher, Sustainable, and Inclusive Growth" at The Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, Chhattisgarh	10-13 December 2024	Dr. P. Murali
87.	Online VC meeting under the Chairmanship of Dr SK Singh, Hon'ble DDG (Hort. Science)	11 December 2024	Dr. P. Govindaraj
88.	Online meeting regarding iGOT for all the ICAR employees	12 December 2024	Dr. P. Govindaraj and Dr P. Malathi
89.	Online Lecture on "Best practices for project formulation" delivered by Dr.Himanshu Pathak, Secretary DARE and Director General, ICAR	16 December 2024	Director and all scientists

S.No	Title	Date	Participant(s)
90.	Meeting about sugarcane varieties and recovery in the State of Punjab with MD, Sugarfed, Punjab, Mohali	17 December 2024	Dr. M.L. Chhabra Dr. Ravinder Kumar
91.	Online meeting on TAAS Award and Foundation Day Lecture	20 December 2024	Dr. P. Govindaraj
92.	SISMA-TN review meeting with sugar factory officials held at ICAR-SBI	23 December 2024	PI and Co-PIs of SISMA project

16 Distinguished Visitors

- Dr. R.C. Agarwal, DDG (Education), ICAR visited the Institute on 23 February 2024.

DDG (Education), ICAR at the Institute

- Shri, Manoj Ahuja, the Secretary, Ministry of Agriculture and Farmers Welfare and his team visited the Institute on 9 March 2024.

Secretary, Ministry of Agriculture and Farmers welfare Govt of India at ICAR-SBI

- Dr. T.R. Sharma, DDG CS ICAR visited the Institute on 01 April 2024.
- Dr Himanshu Pathak, Secretary, DARE & Director General, ICAR visited the Institute on 11 July 2024.
- Dr. T.R. Sharma, DDG (Crop Science), ICAR, New Delhi visited ICAR-SBIRC, Karnal on 24 July 2024
- Shri. Jagannath Sami, Fiji High Commissioner of India visited the Institute on 12 August 2024.

Fiji High Commissioner of India at ICAR-SBI

- Dr. Trilochan Mohapatra, Chairman, PPVFRA, former Secretary, Department of Agricultural Research and Education (DARE) and former Director General of the Indian Council of Agricultural Research, visited on 09 September 2024.

Chairman, PPVFRA Govt of India at ICAR-SBI

- Dr. Major Singh, Member (Plant Science), ASRB, New Delhi visited the Institute and presided over the 113th Foundation day celebration held on 25 October 2024.

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