Souvenir de Presentation

8th IAPSIT International Sugar Conference Sugarcon 2024 & Sugar Expo

Building a Resilient and Sustainable Global Sugar & Bio-energy Industry: Transforming ASEAN Sugar Sector

Venue : ICISE, Quy Nhon, Vietnam

September 16-19, 2024

Compiled by

G.P. Rao
S. Solomon
Yang Rui Li
Priyanka Singh
R. Manimekalai

IS-2024

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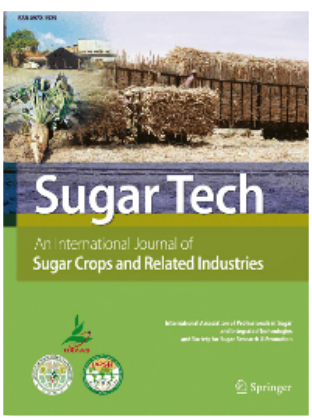

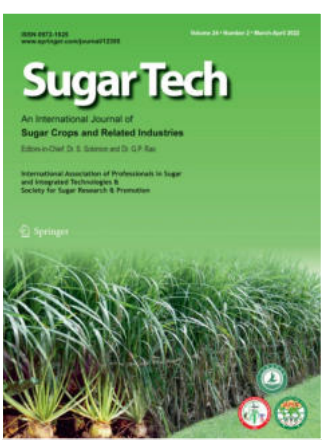

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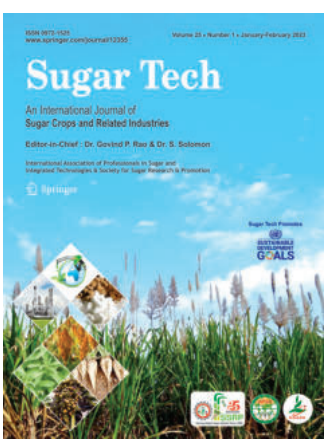

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Foreword

Agriculture is a fundamental aspect of life in the ASEAN region, with eight out of ten countries relying on agricultural activities. Among the important crops in this area is sugarcane, which occupies nearly 2.8 million hectares and plays a significant role in the global sugar trade, contributing approximately 10% of the world's sugar production. The ASEAN countries collectively produce over 17 million tons of sugar annually, with domestic consumption at around 15.8 million tons. Thailand, the largest sugar exporter from the region, exports approximately 3-4 million tons each year. However, ASEAN nations typically import between 5 to 6 million tons of sugar annually, with cane sugar being the primary sugar commodity traded internationally.

Despite the favorable conditions for sugarcane cultivation in the region, productivity and overall industry status face several challenges. Most sugarcane farms in ASEAN are small, rainfed, manually harvested, and characterized by relatively low input levels and productivity, averaging between 50-60 tons per hectare per year—substantially below the global average. Additionally, climatic changes, such as the El Niño phenomenon, have further impacted sugarcane cultivation in these nations. In response, ASEAN governments are undertaking initiatives to address these challenges. Recent economic developments, including the establishment of the ASEAN Economic Community (AEC) and the ASEAN Free Trade Area (AFTA), alongside various reforms, have spurred these countries to adapt to emerging situations and enhance their global competitiveness.

Sustainable agricultural practices and diversification are crucial for the long-term viability of the ASEAN sugar industry. Implementing green technologies in sugarcane production management—such as precision farming, integrated disease and pest management, UAV-assisted crop surveillance, and the use of bio and organic fertilizers—can help reduce environmental impacts and improve crop productivity, particularly in countries like Vietnam, Indonesia, Cambodia, and Myanmar. The adoption of water-efficient irrigation systems, climate-smart agro-technologies, crop rotation, intercropping, and the cultivation of location-specific, multiple stress-tolerant sugarcane varieties are essential for coping with the pressures of climate change. By fostering partnerships, embracing technological advancements, and prioritizing sustainability, ASEAN nations can unlock the full potential of their sugar industries, maintaining high productivity levels while contributing significantly to regional economic development and food security.

The International Sugar Conference ISC-2024 represents a valuable opportunity to discuss and deliberate on technological advancements and strategies for the ASEAN sugar sector. This conference aims to prepare a roadmap for accelerating variety development through new breeding methodologies, improving cropping systems, introducing mechanization, and boosting sugarcane productivity in the face of changing climatic conditions. Additionally, it will explore avenues for product diversification and the utilization of green energy derived from sugarcane. By addressing these key areas, we can enhance the sustainability and resilience of the sugar industry while supporting regional economic development and food security.

G.P. Rao
S. Solomon
Yang Rui Li
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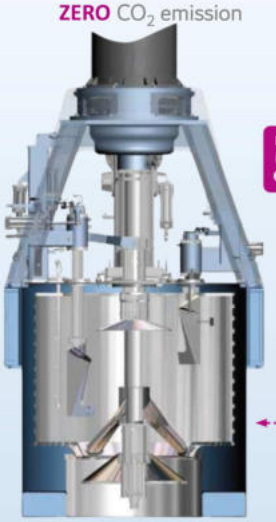

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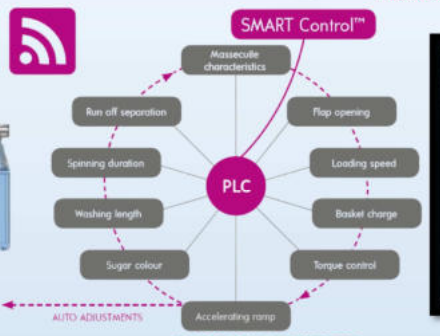

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Date : August 14, 2024

Message

I am glad to inform you that the 8th International Sugar Conference (ISC-2024) will be held at Quy Nhon, Bin Dinh, Vietnam from 16-19th September, 2024. International Association of Professionals in Sugar and Integrated Technologies (lAPS IT) and Society for Sugar Research & Promotion (SSRP) have together organized sugar conference in China, Thailand, India, Egypt and now in 2024 we are ready to welcome you in the beautiful city of Quy Nhon in Vietnam. The ISC-2024 conference venue is world famous International Centre for Interdisciplinary Science & Education (ICISE), which has successfully organized over 195 national and international conferences. The ISC-2024 is supported by many leading sugar organizations, industry and professional societies.

The theme of the ISC-2024 conference is Building a Resilient and Sustainable Global Sugar & Bio-energy Industry- Transforming ASEAN Sugar Sector. We are expecting over 300 delegates from 28 countries who will share their innovative researches, technologies and views on sugar crops, sugar and bioenergy to increase the sustainability and profitability of sugar industry. It would be our pleasure to receive delegations from all countries who are growing sugarcane and sugar crops for sweeteners and energy purposes. I would especially request sugarcane researchers, sugar industry personnel and university students to attend this conference and explore global linkages for the holistic development of sugar sector in their country.

Besides conference program, we have planned a visit to interact with Vietnamese sugarcane farmers in a sugar mill area, beautiful beaches of Quy Nhon, shopping arcades, and delectable Vietnamese cuisine during your stay. When you are in Vietnam you may also include visit to beautiful Ha long bay, Dalat- City of Eternal Spring and historical Saigon city in your itinerary. I hope the academic, research and development contents of ISC-2024 will immensely benefit ASEAN sugar sector.

On behalf of lAPS IT and the Organizing Committee of ISC-2024 , I am pleased to invite you in this event at Quy Nhon, and hope that your gracious presence will be blessing for all the participants.

Yang-Rui Li
Prof. (Lifetime), Director of Sugarcane Research Centre, Chinese Academy of Agricultural Sciences, GXAAS, Guangxi, Nanning, P.R. China
& President, IAPSIT

Dr.S.Solomon
Advisor, Indian Sugar & Bioenergy Manufacturers Association (ISMA), New Delhi
Director, Indian Institute of Sugarcane Research, Lucknow-India (2011-2014)
Vice Chancellor, CSA University of Agriculture & Technology, Kanpur (2016-2020)
President, Society for Sugar Research & Promotion (SSRP), India
Email: presidentssrp@gmail.com; ssrp1999@gmail.com; drsolomon.isma@gmail.com

Date : August 19, 2024

Message

The challenge of sustainability has emerged as a primary concern across numerous industries globally, including the sugar sector and has also impacted ASEAN Sugar Industry. The sugar industry occupies a unique position and has the potential to make significant contributions to various vital Sustainable Development Goals(SDGs). The industry has been supporting SDGs through diverse strategies, such as diversification, incentive to green energy, ,bio-ethanol & SAF production, green energy from biomass & bagasse, and the development of bio-based products such as bioplastic. In this endeavor, developing countries are committed to harness the inherent potential of sugarcane, biomass and bioproduct for a greener and more resilient future. The ISC-2024 conference organized with the support of IAPSIT, SSRP, VAAS, STAI and many leading research organizations is an effort to highlight various initiatives and technologies that are relevant to ASEAN sugar industries in promoting economic growth, environmental stewardship, and social well-being, thereby paving the way for a more sustainable and climate resilient future.

The ASEAN countries, contributes around 10% of global sugar production and therefore play a vital role in global sugar trade and significantly impact regional socio-economic development. However, emerging challenges such as economic uncertainty, agricultural policies related to production, marketing and trading of sugar, climate changes, policies and measures to promote the transition to a low-carbon economy, and the sustainability trend will have tremendous impact on the sugar industry. It is imperative that sugar industry, especially in developing countries must quickly adapt to address these challenges and elevate their competitiveness sustainably in the global market. The industry and researchers must continually explore innovative solutions for the sustainable utilization of sugarcane crop, biomass, residues, and by-products with minimal disturbance to carbon, water and energy footprints. Progressive diversification within the industry will provide a viable pathway to address these challenges.

The ISC-2024 conference on Building a Resilient and Sustainable Global Sugar & Bio-energy Industry- Transforming ASEAN Sugar Sector will address some of these issues and help in promoting inter-institutional collaborations, exchange of new technologies, academia-sugar industry collaboration for the sustainable development of ASEAN sugar sector.

The Organizing Committee welcome you in the city of Quy Nhon, we hope that your active participation will encourage and enrich all stakeholders for sustainable development of sugar industry.

We wish our esteemed participants a pleasant and memorable stay in Vietnam.

(S.Solomon)

Dr. G.P. Rao
ICAR-Emeritus Scientist
(Crop Protection)
Secretary, SSRP & IAPSIT

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Message from IS-2024 Organizing Secretary

It is my profound privilege and pleasure that Society for Sugar Research & Promotion, New Delhi and International Association of Professionals in Sugarcane Technologies, Nanning, China are jointly organizing International Sugarcane Conference (Sugarcon 2024) with support of ICISE, Quh, Nhon, Vietnam from September 16-19, 2024. Sugar crops have been cultivated for human and animal consumption for many centuries, and in recent years its potential is being increasingly exploited for their immense agro-Industrial and value addition values. Sugar crops are potential source of renewable energy, bio-fuels, bio- electricity and bio-materials, value-added products as well as a food crop and widely recognized as a source of rural livelihoods and socio-economic transformation. In the last one decade, sugar industry priority was on the sustainability of sugar industry encompassing climate resilient technologies, diversification, mechanization and AI & ML in sugar crops value chain. The contemporary sugar Industry is focusing to create sustainable value for the farmers by improving resource efficiency, revitalizing ecosystems and uplifting rural communities. Sugarcane farmers especially, smallholders are trained and exposed to sustainable agriculture practices in sugarcane cultivation, including water saving technologies, green technologies, mechanization, bio-pesticides, bio-fertilizers & bio-agents etc. thus limiting any negative impact on the environment. Sugar mills in major sugar producing countries such as Brazil, India, China, Australia and Thailand are practicing environmental sustainability through use of fewer resources and low emissions and waste during processing of raw material and by-products. The sustainability strategy is an inherent part of business plan and consistent with the commitment to contribute to the society.

This Conference on "Building a Resilient and Sustainable global Sugar & Bio-energy Industry: Transforming ASEAN Sugar Sector" will be an ideal platform to discuss the future prospects of sugar crop and bio-based related industries especially focusing ASEAN countries. This Souvenir & Abstracts book is a brief account of recent updates in research and developmental activities in the sugar and integrated industry sector taking place at global level.

We have also published a special of Sugar Tech journal on this occasion. I am happy to share that we are c celebrating the 25th anniversary of SSRP and Sugar Tech journal and organizing diverse national and international activities at the eve of 25th anniversary of the Society.

On behalf of Society for Sugar Research & Promotion, New Delhi and IAPSIT, China and Organizing committee of Sugarcon 2024, I welcome all the delegates from over 15 countries and exhibitors of Sugarcon 2024, and extend my best wishes for a grand successIS-2024 at ICISE, Quh, Nhon, Vietnam.

(Dr. G.P. Rao)
Organizing Secretary
ISC-2024 & Sugarcon-2024 Conf.,
Quh Nhon, Vietnam

Date : August 12, 2024

The Sugar Techologists' Association of India

Sanjay Awasthi
President

(Founded in 1925)

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Message

I have pleasure in welcoming the members to the 8 th edition of IAPSIT International Conference ISC-2024 that is being held jointly by The International Association of Professionals in Sugar & Integrated Technologies (IAPSIT), Society for Sugar Research & Promotion (SSRP) and The Sugar Technologists Association of India (STAI) from 16-19 September 2024 at ICISE (International Centre for Interdisciplinary Science and Education) Quy, Nhon, Binh Dinh, Vietnam.

The world sugar market has become increasingly complex and competitive with the imposition of WTO regulations and formation of several economic blocks. These have affected sugar production, consumption and trade with inevitable consequences for the sugar industry in developing countries which are already plagued with low efficiency and a high cost of production. To build a strong and sustainable sugar industry in developing countries which contributes over 70% of global sugar, the production system needs to be re-engineered to obtain maximum efficiency.

The conference is taking place at the right time and on an apt theme – "Building a Resilient and Sustainable Global Sugar & Bio-energy Industry: Transforming ASEAN Sugar Sector". The ISC 2024 will provide a grand opportunity and a vibrant platform with a convergence of all concerned stakeholders from across the globe.

In course of the three days event, the participants will also have the interact with the world-renowned experts, technology providers and academia who will be presenting their views on the sustainable roadmap for a profitable and sustainable sugar industry. I hope that the conference will provide an interactive and engaging platform to the participants to share new experiences, ideas on changing consumer perspective, continued focus on diversification, research and technologies.

Quy Nhon is a hidden gem nestled on Vietnam's central coast, where pristine beaches, ancient history, and vibrant culture come together to create a dream-like travel experience. With its untouched natural beauty, charming fishing villages, and warm, laid-back atmosphere, Quy Nhon offers a refreshing escape from the bustling cities and tourist hotspots. Apart from knowledge sharing, I would urge the members to take out the time and also visit the beautiful attractions in the city.

On behalf of the STAI Council, I extend a very warm welcome to all the participants of the 8 th IAPSIT Conference & Expo and hope that you all have a great time and useful interactions ahead during the event!

My all-best wishes for a grand success of International Sugar Conference, Sugarcon 2024.

Date : August 17, 2024

(Sanjay Awasthi)

Message

Date : August 18, 2024

I am pleased to know that the International Centre for Interdisciplinary Science and Education (ICISE) is holding an international conference on Sugar crops which is the first of its kind to be organized at our center. I consider it to be a great honor for ICISE to organize a conference on sugarcane and sugar crops which caters to the needs of Sugar and its allied industries, having presence in over 110 countries. The Rencontres du Vietnam/ICISE, a partner of UNESCO, is a unique science and education institution located in the coastal city of Quy Nhon, Vietnam. This organization welcomes national and international Conferences, specialized professional colloquia, as well as selected Thematic Schools, in particular for doctoral students and has full support and appreciation of the local and national authorities. It was commissioned by the association '*Rencontres du Vietnam'* to bring together scientists from developed and developing countries to host national and international conferences. It is a matter of great pride that many leading sugarcane & sugar organizations such as IAPSIT, STAI, VAAS, UPSMA, VSI, Pune, SBI, Coimbatore, IISR, Lucknow, LASUCO and KCP in Vietnam, are jointly organizing this conference on *Building a Resilient and Sustainable Global Sugar & Bio-energy Industry-Transforming ASEAN Sugar Sector.* This is for the first time that ICISE is holding a conference on natural sweeteners.

As far as I understand, sugar crops based natural sweeteners are an important component of human nutrition and have diverse industrial applications. The sugarcane and integrated industries have special socio-economic importance in the developing countries due to their diversified multi-utility products of mass consumption and potential to generate employment. However, performance of this sector in the ASEAN region especially in Vietnam has been badly hit by the high cost of sugar production, climate change, high transportation cost and unprotected domestic sugar market. I am glad to know that IAPSIT, SSRP, and STAI have taken initiative to revitalize the ASEAN sugar sector by bringing together researchers, technologists, managers, and policy planners from many progressive sugarcane & sugars producing countries. These experts will delve on various important issues viz. sustainability models for ASEAN sugar industry; productivity improvement through improved varieties and agrotechnology, climate change adaptation strategies, green energy alternatives & diversification, bio-based & value- added products, biofuels etc. for the long-term sustainability of ASEAN sugar industry.

There is immense scope to improve sugarcane productivity in many areas of Vietnam, however due to inadequate R&D support, its production, productivity, and quality *per se* have not shown any remarkable improvement. This conference is a great opportunity and initiative to foster technological partnerships for the productive advancement of the ASEAN sugar sector, especially Vietnam.

On behalf of "Rencontres du Vietnam" and ICISE, I congratulate the organizers for holding this conference in ICISE, Quy Nhon, Vietnam. I am hopeful that the deliberations and recommendations during this conference will be fruitful for the holistic development of the sugar-energy industry in Vietnam and Southeast Asia.

I heartily welcome all the esteemed delegates who have come to attend this conference in Quy Nhon and extend good wishes for the grand success of ISC-2024 conference.

Jean Tran Thanh Van
President of Rencontres du Vietnam
Director of ICISE

Date : August 18, 2024

MESSAGE

I am proud to welcome the global Sugar and Bioenergy experts to 8th IAPSIT International Sugar Conference (ISC-2024) organized in ICISE, Quy Nhon, Vietnam, from September 16-19, 2024. The International Association of Professionals in Sugar & Integrated Technologies (IAPSIT), Society for Sugar Research & Promotion (SSRP) and International Centre for Interdisciplinary Science & Education (ICISE), are jointly organizing ISC-2024 in the beautiful coastal city of Quy Nhon, Vietnam, where Quy Hoa Science Urban Area is located with ICISE as its core. The conference is supported by many professional societies and sugar institutes associated with sugarcane, sugar, and bioenergy. This international center was commissioned by the 'Rencontres du Vietnam' Association under the direction of its founders Prof. Jean Tran Thanh Van and Prof. Le Kim Ngoc, to bring together scientists from developed and emerging countries to host conferences. Each year, ICISE hosts high-level international scientific conferences covering fundamental and applied sciences, including biology, medicine, social and human sciences. We are proud to organize the first sugar industry conference at this esteemed venue.

At ISC-2024, we expect delegates from the ASEAN region to engage in discussions on sustainability issues related to sugar crops and the sugar industry. The Vietnamese sugar industry will be particularly interested in topics such as new sugarcane varieties, innovative agro-technologies, water management, climate-resilient sugarcane agriculture, intercropping, bio-based products, sugar processing and valorization, biotechnology, green energy alternatives, and training programs on sugarcane crop production and management. I hope that industry leaders, researchers, planners, and forward-thinkers will empower our sugar industry with advanced knowledge and foster deeper collaboration.

On behalf of the local Organizing Committee, I would like to extend a warm welcome to you in the city of Quy Nhon. I hope you enjoy the conference, the ambiance, and the Vietnamese cuisine, and that you return with happy memories of our beautiful country.

We wish you a pleasant stay in Quy Nhon.

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TRẦN Thanh Sơn, Ph.D

Vice Director of ICISE/ Organizing Secretary ISC-2024

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Tel: +84 274 3562227 – Fax: +84 274 3562267
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July 22nd, 2024

Dr. Cao Anh Duong
Director General
SUGARCANE RESEARCH INSTITUTE (SRI)

Message

I am happy to know that the global Sugar and Bioenergy fraternity will be congregating during 8th IAPSIT International Sugar Conference (ISC-2024) being organized in Quy Nhon city, Binh Dinh province, in Vietnam, from 16-19th September, 2024. The International Association of Professionals in Sugar & Integrated Technologies (IAPSIT), Society for Sugar Research & Promotion(SSRP) and International Centre for Interdisciplinary Science & Education(ICISE), are jointly organizing ISC-2024 in Quy Nhon, Vietnam for the first time. The conference is supported by many professional societies and sugar institutes associated with sugarcane, sugar and bioenergy including Vietnam Sugarcane and Sugar Association (VAAS). The conference on *Building a Resilient and Sustainable Global Sugar & Bio-energy Industry- Transforming ASEAN Sugar Sector* will be attended by experts on sugarcane & sugar crops production, processing & diversification and be are looking forward to learn many innovative technologies from global experts.

The ASEAN sugar industry occupies a unique position and has the potential to make significant contributions to the world sugar-ethanol business. Vietnam is an important sugar producer in this region, sugar industry and Government has been supporting diverse R & D program including the area expansion, milling capacity , funding for the development of new varieties & ago-technologies, utilization of sugarcane byproducts for alternative purposes such as ethanol production, cogeneration of energy from cane bagasse, and the development of bio-based products for the holistic growth of this sector.

In this conference, we are hopeful that global industry leaders, researchers, planners and forward-thinkers will address various problems and solution related to climate change, productivity, soil fertility, green technology and environment management. On behalf of the Sugar industry of Vietnam, I am pleased to welcome all the delegates and hope that they will empower our industry with the new knowledge and more intense collaboration for the sustainable development.

I wish the ISC-2024 Quy Nhon, Vietnam a great success!

Dr. Cao Anh Duong
Director General of SRI

Narendra Mohan

*Former Director, National Sugar Institute, Kanpur
*Expert, Cogeneration Association of India
*Advisor, Deccan Sugar Technologists Association of India
*Member, International Society of Sugarcane & Sugar Technologists
*Life Member, Association of Food Technologists of India
*Life Member, The Sugar Technologists Association of India

Message

I am delighted to learn that the International Association of Professionals in Sugar and Integrated Technologies (IAPSIT) and Society for Sugar Research & Promotion (SSRP) are organizing 8th International Sugar Conference on "Building a Resilient and Sustainable Global Sugar & Bio-energy Industry: Transforming ASEAN Sugar Sector" in Quy Nhon, Vietnam.

Sugar Industry is always considered as an industry of immense possibilities considering the valuable biomass available for valorization. However, for various reasons including fluctuating profits from sugar business, sustainability of the sugar industry in many countries has remained a challenge. In many sugar producing countries, this industry plays a pivotal role and is considered as industry to be considered as "Growth Engine of Rural Economy". In an era marked by environmental challenges and changing consumer preferences, the focus on diversification & sustainability is important for the sector's long term viability. There are many factors which influence sustainability of sugar industry and often we talk about few P's (Policy, Productivity and Product). For being sustainable, industry needs to develop "out of box thinking" to exploit potential of entire sugarcane value chain including sugarcane plant residues for producing innovative & value added products. In-fact the future of sugar industry lies in converting itself to bio-refineries producing bio-food, bio-energy, bio-chemicals and bio-water. The business models can be drawn considering local conditions in a sugar producing country. We have to see that it becomes an industry working 365 days in a year and not for couple of months.

Besides economic sustainability, environmental sustainability should remain high on agenda. Hence, another area to work upon is for converting waste to wealth. Already there are many examples have been created on capturing carbon di-oxide from distillery fermenters for miscellaneous uses and recovery of potash from the spent wash or ash of incineration boilers in the molasses based distilleries. This is to be taken forward to have more revenue stream and to address environmental issues. Further, already taken up by the Indian Sugar Industry and that of some other countries too, we have to make efforts to minimize fresh water usage from farm to factory and to control emissions in any form.

I am hopeful that this Conference will provide an exclusive platform to the stakeholders to share their vision for addressing challenges before the sugar industry and in propagating eco-friendly innovative technologies. I congratulate the organizers of this conference and wish them a grand success.

(Narendra Mohan)

Date : August 5, 2024

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डॉ. रासप्पा विश्वनाथन
निदेशक
Dr. Rasappa Viswanathan
Director

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ICAR- Indian Institute of Sugarcane Research
Raebareli Road, Post Dilkusha, Lucknow-226002, India

Message

Across the globe, sugarcane is getting transformed into a bioenergy crop, apart from being a food crop. Although demand for sugarcane is rapidly increasing, global production of sugarcane and sugar remains almost stable during the last few years. The countries like Brazil, India, China, Thailand and few others dominate the sugarcane production scenario. In Asia, India, China, Thailand, Pakistan, Vietnam and Indonesia are the major players in the sector. Cane productivity needs to be improved across the countries to meet the growing demand of domestic and industrial consumption. Cane productivity remains low in Nepal, Bangladesh, Myanmar, Srilanka, Iran and other Asian countries.

Cane productivity is constrained by various biotic and abiotic factors in the region. The major fungal diseases like red rot, smut and wilt pose serious challenges to sugarcane production, affecting stability of cane production. The phytoplasma diseases like grassy shoot and white leaf diseases are prevalent in the Asian region. Lack of awareness on viral and other non- fungal diseases causes cane yield decline in different countries and there is a need to adopt systematic healthy seed nursery programmes to improve potential yield of cane varieties. Different abiotic constraints like drought, waterlogging and soil salinity in various countries affect cane production and soil health is also affected due to monocropping in Asia. Further, there is a need to augment soil organic carbon to sustain soil productivity.

Ascompared to countries in the American Continent, Africa and Australia, Asian countries have a peculiar situation of small farm holdings, poor adoption of farm mechanization and lack of integrated farming practices. Hence sugarcane mechanization needs a special thrust for Asian countries to develop and popularize machineries and this will reduce cost of cultivation and timely harvesting. Mechanized harvesting will ensure a uniform establishment of ratoons and ultimately it improves ratoon crop yields. Encouraging developments occurred in the areas of Al and loT adoption in sugarcane farming and these technologies will support an integrated sugarcane crop management.

At this juncture 8th IAPSIT International Sugar Conference ISC-2024 & Sugarcon-2024 is being organized with the theme on 'Building a Resilient and Sustainable Global Sugar & Bio- energy Industry:Transforming ASEAN Sugar Sector' during 16-19 September, 2024 at ICISE, Quy Nhon, Binh Dinh, Vietnam. The Sugarcon-2024 will deliberate on various needs of sugar industry and also to address research gaps to improve cane productivity and sustain cane cultivation in different countries. I congratulate efforts taken by Dr S. Solomon and Dr. G.P. Rao in organizing the event at Vietnam. A good number of scientific and industry delegates are expected to attend the Conference and the delegates will be immensely benefited from the deliberations of Sugarcon-2024 as it is going to be more informative and interactive. I wish a grand success of Sugarcon-2024.

Date : August 10, 2024

(R. Viswanathan)

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डॉ जी. हेमप्रभा
Dr. G. Hemaprabha
Director

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(An ISO 9001 : 2008 certified Institute)

Message

It is indeed delightful to learn that the International Centre for Interdisciplinary Science and Education (ICISE) is organizing an International conference on sugarcane and sugar crops at Rencontres du Vietnam, in the sea-kissed city of Quy Nhon during September, 2024. With its presence in over 110 countries, ICISE has been actively catering to the needs of Sugar and its allied industries and has successfully connected the international players of sugar sector through its several meetings, which is laudable. Quite a lot of excitement and expectations are for the participants for the present conference on 'Building a Resilient and Sustainable Global Sugar & Bio-energy Industry-Transforming ASEAN Sugar Sector' which is jointly organized by many leading sugarcane & sugar organizations and research institutes.

Sugarcane (Saccharum spp. Hybrids) is one of the most prominent industrial crops in the world, being cultivated in over 100 countries. Sugarcane, the major source of sugar and sweeteners to a tune of 79 percent globally, is also considered as the best biofuel crop in the equatorial and tropical regions. Sugarcane is a widely grown crop in India, except in the sub Himalayan regions and the country's varietal demands have been largely met by the varieties of ICAR Sugarcane Breeding Institute, Coimbatore, which has a breeding history of over 112 years. The Institute has been the major player in making India the second largest producer of sugarcane, next to Brazil, through its varieties, known as "Co canes" which have made great impact domestically and in global level, the Co canes are/ were cultivated in 28 countries. It is indeed a proud moment for this Institute to be part of this international scientific conference to share our experiences and to learn from the global partners.

The area under sugarcane in India has been almost static between 5. 0 Mha to 5.7 MHa. The average sugarcane farmer has a farm holding of about 0.85 ha, and are largely connected with the sugar industry. At this juncture, when sugarcane has diversified for multipurposes of food, fuel, fertilizer, feed, paper, electricity and many other applications including pharmaceuticals, both the conventional stakeholders as well as new players and entrepreneurship development are now booming across the country for producing varied commodities for internal use and export. The favorable start-up ecosystem in the country as well as the increasing agritech innovation capability are catalysts that further give scope of opportunities for the crop. At the same time, the changing climate and mounting scarcity of inputs to enable a good sugarcane agriculture pose serious challenges. I am aware, this is the case with a few other countries as well. Considering all these growing opportunities as well as mounting magnitude of challenges, the expertise of the global group could be shared and understood by the participants of this conference, for fine tuning their skills and to extend collaborations with the sugar industry, other R&D industries as well as with FPOs, and startups for developing and demonstrating viable and eco-friendly technologies. I wish all success to this conference and hope that more collaborations for product diversification and input use- efficiency would be established with the goal of increasing productivity and profitability, while focusing more on sustainability to save invaluable natural resources.

On behalf of ICAR SBI, India, I congratulate the organizers for holding this meeting in Vietnam and I am sure that the proceedings and recommendations of this Conference would further co-operation among the participating nations in the area of sugarcane research and to foster the Indian principles of One Earth, One family, one future.

Date : July 10, 2024

(G. Hemaprabha)

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Thailand Society of Sugar Cane Technologists (TSSCT)

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มหาวิทยาลัยเกษตรศาสตร์ เลขที่ 50 ถนนงามวงศ์วาน แขวงลาดยาว เขตจตุจักร
กรุงเทพมหานคร 10900

Wirat VANICHSRIRATANA
President
Thailand Society of Sugar Cane Technologists (TSSCT)

Message

The ASEAN nations play a significant role in the global sugar production & trade, collectively contributing about 10% of the world's sugar production. These countries produce over 17 million tons of sugar annually, with sizable imports and exports and meet domestic consumption requirement to a great extent. The annual import volume across ASEAN countries is nearly 6 MT, with cane sugar being the primary internationally traded sugar variety from the region. Despite favourable conditions, cane productivity, sugar production, and the overall status of the sugar industry in these nations face challenges specific to the region. Sugarcane cultivation across ASEAN nations has been impacted by climatic changes like El Nino phenomenon over the years and this has affected the economic sustainability of sugar sector in south east Asia. Sugarcane is one of the Thailand's top agricultural crops with the current cultivated areas of over 1.76 million hectares and 130 million tons of cane crushed, producing over 14 MT of sugar annually. Thailand used to rank as the second-largest sugar exporter worldwide after Brazil. The sugar sector in Thailand is faced by many challenges such as low sugarcane yield as cane areas is rain-fed with only 10% in irrigated zones due to the relocation of cane area in the North-eastern region; recurrent drought & climate changes which are causing serious damage to crop productivity and quality; poor cane management leading to emergence of diseases and pest; and variable cane quality due to preharvest cane. Extensive R & D efforts and policy amendments are needed to address these emerging challenges for sustaining the Thai sugar industry. I am glad to know that ISC-2024 Conference focused on ASEAN sugar sector is being organized in Quy Nhon, Vietnam by IAPSIT and other international societies including TSSCT. In the upcoming conference on Building a Resilient and Sustainable Global Sugar & Bio-energy Industry-Transforming ASEAN Sugar Sector issues related to sugarcane & sugar crops production, climate smart technologies, processing & valorization, biotechnology, green energy alternatives, and other relevant topics will be discussed. I hope that the industry leaders, researchers and planners will discuss on these issues relevant to ASEAN sugar sector and empower the industry with knowledge and more intense collaboration for their sustainable development. I wish the conference a great success.

W. Vanichsriratana

Date : August 8, 2024

Wirat VANICHSRIRATANA

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HIỆP HỘI MÍA ĐƯỜNG VIỆT NAM
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MBA **Nguyen Van Loc**
Chairman
The Vietnam Sugarcane and Sugar Association (VSSA

Dated: 16. 09. 2024

Message

It gives me immense pleasure to welcome the global Sugar and Bioenergy fraternity to The 8th IAPSIT International Sugar Conference (ISC-2024) being organized in Quy Nhon, Bin Dinh, Vietnam, 16-19th September, 2024. The International Association of Professionals in Sugar & Integrated Technologies (IAPSIT), Society for Sugar Research & Promotion(SSRP) and International Centre for Interdisciplinary Science & Education(ICISE), are jointly organizing ISC-2024 in the beautiful coastal city of Quy Nhon, Vietnam, popularly known as Happy City. The conference is supported by many professional societies and sugar institutes associated with sugarcane, sugar and bioenergy. The Vietnam Sugarcane and Sugar Association (VSSA) which is playing a key role in improving the competitiveness to integrate Vietnam sugar industry into the international economy will be happy to develop collaborative programs to modernize sugar industry in Vietnam. The VSSA is on the forefront of farmers welfare agenda and their active participation in the developmental process to make the industry self-reliant through innovative approaches in sugarcane agriculture, processing and diversification.

I am glad to know that in the forthcoming ISC-2024 conference on *Building a Resilient and Sustainable Global Sugar & Bio-energy Industry- Transforming ASEAN Sugar Sector* interesting issues relevant to Vietnam sugar industry will be discussed especially sugarcane production management, green technologies, climate smart sugarcane agriculture, processing & valorization, biotechnology, bio-fuels, bio-based products, green energy alternatives, and SDGs. VSSA is particularly interested to develop inter-institutional collaborations, exchange of new technologies, academia-sugar industry collaboration for the long term sustainability of sugar-energy sector in Vietnam. Sugarcane and sugar industry needs to produce quality sugarcane material in 250,000 hectares in 2025 and 300,000 hectares in 2028 to meet the domestic sugar requirement. This require a quantum jump in cane productivity, sugar recovery and appropriate measures to strengthen the sugarcane production chain, especially in the context of competition between sugarcane and other crops vis-à-vis climate change. We are therefore expecting that global industry leaders, researchers, planners and forward-thinkers will unite in this noble endeavor and empower our cane and sugar technologists with knowledge as well as more intense collaboration for the sustainable development of sugar sector.

On behalf of VSSA, and sugar industry of Vietnam, I welcome all the delegates to ISC-2024 conference and wish a grand success to this event.

(Nguyen Van Loc)

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Dated: 30th July 2024

MESSAGE

I am happy to know that the International Sugar Conference, ISC-2024 on Building a Resilient and Sustainable Global Sugar & Bio-energy Industry- Transforming ASEAN Sugar Sector will be held at ICISE, Quy Nhon, Vietnam. Besides discussion on various issues related to sugarcane production management, processing & valorization, biotechnology, green energy alternatives, the conference will also promote inter-institutional collaborations, exchange of new technologies, academia-sugar industry collaboration and encourage young researchers & students to work on the long term sustainability of sugar-energy sector. This will be a unique opportunity for the sugar sector of Vietnam to interact with the sugarcane and sugar technologists and implement relevant technologies for the holistic development of sugar industry.

KCP Vietnam Industries Limited (KCP VIL) is one of the top five sugar producers in Vietnam. Company has taken multiple initiatives for the socio-economic development of farming community and committed to make sugar sector self-reliant in sugar production. Since the year 2000, KCP VIL has taken many progressive developmental initiatives and has expanded the capacity of Son Hoa sugar refinery to 10,000 TCD with a 30 MW Bio Mass Co-generation power project and 1,000 TCD Dong Xuan Sugar plant. The growth and expansion of KCP VIL in Phu Yen Province has speeded up and enhanced the socio-economic growth in 58 of the most economically backward communes of the 7 mountainous districts of Phu Yen Province and 2 districts in neighboring provinces. KCP has become the main source of income for about 12,200 farming families, 700 employees working directly and indirectly in the agriculture and transportation sectors and instrumental in developing and maintaining over 25,000 ha sugarcane area. Our continued and consistent efforts have immensely improved quality of cane production as well as sugar manufacturing technology. Encouraged by the management we plan to expand Son Hoa sugar unit to 15,000 TCD and Cogeneration plant to 60 MW and invest in a Distillery project to produce ENA/Ethanol with a capacity of 100 KLPD with an additional capital of 100 M'USD.

We are happy that a group of ISC-2024 conference delegates will be visiting our sugarcane area and interact with the sugarcane farmers. On behalf of KCP VIL Team, I extend good wishes to the Organizers of this conference, ICISE and all the delegates who are participating in this event in the beautiful coastal city of Quy Nhon, Vietnam

We look forward to welcome you all in Vietnam.

For KCP Vietnam Industries Limited

K.V.S.R SUBBAIAH
General Director

Society for Sugar Research and Promotion (SSRP)

(Registered Under Societies Registration Act 1860)

Aims and objectives

- To constitute a forum at international level for bringing together individual and organizations involved in sugar crops and related industry
- To develop international research/development linkages and disseminate up-to-date technologies in the field of sugar production/by-product utilization/effluent treatment/alcohol production and environmental management through rapid information system
- To promote and undertake Research and Development and Extension Services in the field of sugar crops and value added products
- To explore new areas related to cane production technologies, cane developmental activity and logistic management;
- To propagate utilization of non-conventional and renewable sources of energy and development of improved systems and devices in sugar industry for sugar processing including fermentation and effluent treatment technologies;
- To offer recognition and awards to professional groups and individuals for attainment of excellence in the field of sugar crops and related industries;
- To interact with government agencies, scientific organizations and NGOs to promote and protect interests of sugar crop growers and producers;
- To organize symposia, seminars and workshops and bring out scientific publications to meet the objectives of the society.

Sugar Tech is the official journal of SSRP. One hundred five issues in twenty four volumes of Sugar Tech have already been published in last sixteen years. We have been receiving research articles from all over the world. Concerned libraries from all over the World have been subscribing Sugar Tech journal. Sugar Tech has come to be a leading international journal with its unique quality and standard. We have been covering current references on sugarcane, sugarbeet, industry and technology along with addresses of corresponding authors, so that interested person could contact them as per their own interest. Sugar Tech is being indexed in Thomson Reuters, SCOPUS, CAB International, UK; INSDOC, India and Elsevier Biobase, Netherlands and Chemical Abstracts, USA. The Society requests all the scientists/ industrialists/technologists engaged in sugarcane, sugarbeet and related industries to contribute their research findings to Sugar Tech and also to become members of the society with their active participation so that the aims and objectives of the Society could be fulfilled in their true perspectives.

Executive Council

President	**Dr. S. Solomon,** Lucknow, India	email: presidentssrp@gmail.com
Vice-President	**Dr. Yang-Rui Li,** Nanning, P.R.China	email:liyr@gxaas.net
Secretary	**Dr. G.P. Rao,** New Delhi, India	email: sugartech@rediffmail.com
Joint Secretary	**Dr. Priyanka Vishen,** Lucknow, India	email: priyanka.vishen75@gmail.com
Treasurer	**Dr. S.P. Singh,** New Delhi, India	email: singhsp65@gmail.com
Registered Office	A1/307, Shantidoot Apt, Vasundhara Enclave, New Delhi - 110 096, India	

For membership and other activities of SSRP please write to

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E-mail: sugartech@rediffmail.com, Website: www.ssrpglobal.net

International Association of Professionals in Sugar and Integrated Technologies (IAPSIT)

Objectives

- To bring together professionals and organizations related to sugar crops research, production, processing, energy, socio-economic and environmental issues.
- To facilitate linkages and a network among members, scientific organizations and non-government organizations to disseminateup-to-date and relevant technology/information needed for the sugar industries through organizing specialized workshops. seminars, meetings and the exchange of professionals.
- To identify a host country and extend technical support in organizing the International Symposium every two years.
- The IAPSIT Secretariat will approach the government, sugar industry and integrated organizations of the host country to obtain sponsorship for such a symposium.
- To publish a newsletter as part of the Sugar Tech journal, highlighting sugar and integrated industries news from across the developing sugar-producing countries, technological updates, scientific meetings, workshops and other relevant environmental and socio-economic issues
- To support research and development projects and extend services in the environmental and social welfare activities, especially in the areas and communities supported by the sugar industry and to assist in relief work in times of need.
- To provide a base for the affiliation with and of international, national or local relevant societies of sugar crops with the IAPSIT.

Membership of IAPSIT : Individual members: Any professional who has an interest in the objectives of the IAPSIT is eligible for membership. Membership will be approved by the EC. Individual membership fee is US $100 for three years.

Fellow members: Fellowship will be conferred upon individual members who have distinguished themselves in the sugar and integrated industries and have made an outstanding contribution to the LAPSIT. Fellows shall not be required to pay dues and will enjoy full status in the Association. They shall be nominated by the EC and conferred by the President.

Association members: Other societies of sugar crops and integrated technologists represented by an affiliated member. The Association membership fee is US$500 for three years.

Institutional members: Research institutions, universities, industrial and commercial organizations willing to support the objectives of the IAPSIT. The Institutional membership fee is US$450 for three years.

IAPSIT Executive Committee (2019-2024)

President	Dr. YR. Li	China	Joint Secretary	Mr. Q- Z Tang	China
Vice-President	Dr. S. Solomon	India	Treasurer	Dr. Li-Tao Yang	China
Secretary and Publication Editor	Dr. G.P. Rao	India			

IAPSIT Secretariat

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The Sugar Techologists' Association of India

(Founded in 1925)

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The Sugar Technologists' Association of India

The Sugar Technologists' Association of India (STAI) is the national level apex association of professionals associated with the sugar industry and allied fields. It is a non-government not for profit organization, founded in the year 1925 and is headquartered at New Delhi. Presently it has nearly 3000 members working with various sugar mills, refineries, distilleries, research institutes, technology providers and other professionals from sugarcane agriculture, sugarcane biology, sugar technology, factory engineering and co-products. The association, headed by the President, is managed by an elected council comprising of 30 professionals representing different regions of India. The council, elected every three years by STAI members, is assisted by the Standing Committees on Research and Investigation, Advisory Committee on Publications and the Indian National Committee of ICUMSA. STAI is the sole representative from India on the council of the International Society of Sugar Cane Technologists (ISSCT), a global association of scientists, technologists, managers, institutions and companies/corporations concerned with the technical advancement of the cane sugar industry and its co-products. STAI is also a member of International Association of Professionals in Sugar and Integrated Technologies (IAPSIT).

The key objectives of the association are : to provide opportunities for the acquisition and dissemination of information, exchange of knowledge amongst the members and to provide facilities for presentation of papers and delivery of lectures on subjects connected with and useful to the profession; to promote schemes of research relating to the sugar industry and allied fields and to establish and maintain a library and to publish and circulate papers, books, journals, magazines, newsletters and other scientific literature connected with the profession.

STAI has successfully hosted the IX ISSCT Congress in 1956 at New Delhi, the XXIII ISSCT Congress in 1999 at New Delhi and XXXI ISSCT Congress in 2023 at Hyderabad, ISSCT combined Factory Engineering & Processing workshop in 1994 at Pune and ISSCT Factory Processing Workshop in 2003 at Goa. STAI also successfully hosted the 23rd session of ICUMSA in 2002 at Pune and the 4th Session of IAPSIT in 2011 at New Delhi.

STAI has so far successfully organized 81 Annual Conventions and 11 Joint Conventions in collaboration with affiliated associations. The association organizes 4-6 one day seminars/ webinars every year in association with affiliated associations, research institutions and various other stakeholders. The Annual Convention held by rotation in different cities, is spread over three days that includes memorial lectures, plenary sessions and technical sessions on different disciplines for presentation of research papers. International Sugar Expo is also held concurrently with the convention on various products and services.

STAI has a pool of experts and a cumulative store house of knowledge. It is instrumental in developing & promoting vital process technologies & state of the art equipment for sugar and allied industry applications. Dr. G.P. Rao (Emeritus Scientist - ICAR) is the Convenor of the STAI's Standing Committee on Research and Investigation that takes up R&I projects in following areas, with active involvement of various stakeholders: Sustainable Sugarcane Agriculture, Factory Engineering and Energy Efficiency, Sugarcane Processing Technologies and Sugar Quality, Zero Liquid Discharge in Distilleries, Recycling of Sugarcane/Sugar Factory Wastes, Co-Products : Cogeneration, Ethanol, Bio-CNG and Downstream Chemicals.

STAI also recognises the contribution of industry professionals by presenting various awards in different fields of science and technology. STAI has regular annual publications as Directory of Cane Sugar Factories and Refineries (India and other SAARC countries) and Distilleries (India, Nepal and Bhutan); Annual Convention Proceedings and Souvenir and Year Book and Technical Data Directory of Indian Sugar Factories.

Contact

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Vietnam Sugarcane and Sugar Association (VSSA)

Nguyen Van Loc
President, VSSA

Mandate, Mission and Achievements

Vietnam Sugarcane and Sugar Association (VSSA) is a social-professional organization of Vietnamese citizens and organizations operating in the field of sugarcane & sugar production according to the provisions of Vietnamese law. It was voluntarily established for the purpose of gathering and uniting members, protecting the rights and legitimate interests of members, supporting each other to operate effectively, contributing to the socio-economic development of the country.

VSSA is implementing Directive No. 28/CT-TTg dated July 14, 2020 of Viet Nam Prime Minister on implementing solutions to develop Vietnam's sugar industry in the new era. It describes : " To Actively improve competitiveness to integrate into the international economy equally with the spirit of independence and self-reliance;...; forming sugarcane area associated along with sugar factory to create effective operations, competitiveness and sustainable development industry".

In the last 5 years, the Vietnamese sugar industry has suffered severe losses due to the impact of the unequal business environment. VSSA submitted evidences to request initiating an anti-dumping and anti-subsidy investigation for imported sugar from Thailand. Based on VSSA request, VietNam Government decided to apply trade remedies of anti-dumping tax on refined sugar imported from Thailand. Trade remedies have been used effectively to protect the legitimate interests of the domestic sugar industry. The Vietnamese sugar industry has shown positive signs of recovery, including increases in sugar and sugarcane prices as well as the expansion of the planting area.

In addition, climate change is also causing difficulties for the Viet Nam sugar industry. VSSA advised sugar companies to strengthen their linkages with farmers to enable further recovery of the sugar industry. At the same time, sugar companies should expand climate-smart production and apply new technologies in cane sugar production.

VSSA is committed to achieve the following goals:

(i) Strengthening the development of linked chains in sugarcane production: increasing income of sugarcane growers while developing Viet Nam sugar industry.

(ii) Building a healthy sugar market with harmonious development: participating in supplying sugar for the domestic market, keep sugar prices for consumers at reasonable level.

(iii) Preventing international fraudulent sugar trade practices.

(iv) Developing sugarcane area in the context of climate change: applying climate-smart strategies to adapt and develop sugarcane areas.

Over 33 Years of KCP's Journey in S. R. Vietnam

Established in 1941 in India, KCP group is a diversified industrial group engaged in production of Sugar, Cement, Power and manufacture of heavy machinery and equipment for Sugar, Cement, Steel, Power, Mineral processing, Space and Defence sectors and investment in Hospitality sector.

Since 1991, KCP was active in supplying equipment from India for new as well as expansion projects of sugar industry in Vietnam. In 1997, to take part in 1 M' Ton sugar program of Government of Vietnam, KCP established 'KCP Vietnam Industries Limited' (KCP VIL) and invested in a sugar refinery with a capacity of 2,500TCD in Thua Thien Hue province. However due to inadequate raw material, KCP had to shift this project to present location in Cung Son town, Son Hoa dist, Phu Yen province in the year 2000.

Thanks to the Government of Vietnam and Phu Yen leadership for issuing license and approving 72 B'VND long term loan from Vietnam Development Bank (Formerly Development Assistance Fund) for the shifting project. Grateful to the continuous efforts of Phu Yen leadership in creating favourable conditions to KCP VIL during project shifting, demarcation of raw material area, building up relation with the farming community, enhancing capacity and operation. With the full pledged support from the Government and Phu Yen leadership and with cooperation from the farming community over 24 years the success story of KCP could reach to the present level.

Since the year 2000, KCP VIL has been taking long and strong steps of development. From an initial capacity of 2,500 TCD, the capacity of Son Hoa factory has been expanded in stages and to 10,000 TCD with a 30 MW bio mass power Coogneration project in 2017 and Dong Xuan sugar factory has been expanded to 1,000 TCD in 2009 with a total investment capital of 110 M' USD till date. KCP VIL applied highest technologies while investing on these projects.

Over 24 years, KCP VIL procured 16.6 Million tons of sugarcane, produced 1.77 Million tons of refined sugar, paid 19,050 B'VND for raw material, invested 3,714 B'VND on raw material area, paid 1,190 B'VND to the State Budget and contributed 73 B'VND for rural development and social affairs. Operation of KCP VIL in Phu Yen Province has speeded up and stabilized the socio-economic growth in 58 most economically backward communes of 7 mountainous districts of Phu Yen Province and 2 districts in neighboring provinces. KCP VIL has become the main income source for about 12,200 farming families and 700 employees directly and indirectly for thousands of families working in agriculture and transportation sectors. Over 24 years, investment

capital, production capacity and sugarcane area increased 4 times and sugarcane yield increased 2.5 times.

KCP VIL has tried to become a member in top range of Sugar Industry in Vietnam, both in quantity and quality, in prestige and effectiveness of production and business, in the implementation of laws and regulations, promoting favorable policies for farming community and active in social and rural development affairs. KCP VIL has developed the raw material zone over 25,000 ha on the basis of respecting the benefits of sugarcane farmers with a motto of 'farmer benefit first'.

From the beginning KCP VIL took strong steps to connect directly with the farming community by investing on sugarcane fileds in the form of seed, fertilizer, cash etc and consume the sugarcane with a favorable purchase policy through economic contracts under prevailing regulations. Though the pace of investment on sugarcane areas was slow in the beginning, it quickly gained the pace in line with successful implementation of sugarcane consumption contracts in fair and transparent way.

Introduction of non refundable subsidies in the form of interest exemption/reduction on investment in seed, fertilizer, mechanization and irrigation systems, seed to seed exchange policy, purchase sugarcane with out linking to quality (CCS-Commercial Cane Sugar) to create belief to farming community etc had built an atmosphere of trust between both sides. For last one decade the purchase policy has been revised to CCS based to implement technical standard on sugarcane quality stipulated by Ministry of Agriculture and Rural Development and draw the attention of farming community to improve the quality. Under the revised policy based on CCS, KCP VIL created favorable condition to farming community with a guaranteed CCS of 9%.

Over the years, the policies have been updated from time to time to provide relief for farming community in sugarcane cultivation. Against initial subsidies of 10 to 15 B'VND per year, the present subsidies cover 6 to 10 M'VND per ha for land preparation support for plantations and additional support to compensate for natural calamities, interest exemption/reduction on investemnt, supporting 30 to 40% cost of the investment on irrigation systems etc with total non refundable subsidies reaching 50 to 55 B'VND per year in recent years. KCP VIL took strong step to train minimum 30% of the farmers every year with updated sugarcane intensive cultivation practices along with visits to demo plots of progressive farmers, with an aim of achieving yields to competitive level apart from reducing the cost of production, to focus on irrigation to achieve sustainability etc.

When KCP VIL's sugar refinery was constructed, sugarcane varities ROC10, ROC16 etc with high CCS were prominent but these varities faded out quickly due to low drought resistance property. Later KCP VIL took initiative to introduce sugarcane varieties R570 and R579 varieties which were found suitable to the region due to high resistance to drought and served the sugar production over a decade. Subsequently varieties from Thailand suitable to the region with high CCS content with drought

resistantance were introduced. At present KK3 (over 86% of the area), Uthong 11 etc are leading the pack of over 10 Thailand varities prevailing in the region invested by KCP VIL. Over 2 decades, KCP VIL has been associating with Sugarcane Research Institute (SRI), Bencat, Vietnam for experimenting with seeds and at present over 10 varieties are going through trials.

The sugarcane areas are mostly located on sloppy terrains. With strong sugarcane development over decades the regions turned from labour surplus to labour shortage. The farming community was trained to turn to complete mechanization in cultivation through interest free investements recoverable in 2 to 3 years on agricultural implements. For last 5 years harvesters and loaders have been introduced to reduce the labour dependence. At present 3 harvesters are in operation and KCP VIL will continue to tie up with enterprises to employ more harvesters. At present more than 70 loaders are in operation to load the manually harvested sugarcane on to the trucks reducing labour dependency in a big way and reduce the costs.

Over three decades, the sugarcane development has taken twists and turns in Vietnam. Initially majority of the sugarcane was grown in irrigated fields of Mekong Delta in South but due to subsequent switch over to fruits and vegetables with better returns out of exports the sugarcane area got drastically dropped down. Later North region recorded strong development of sugarcane but slowly the fall in the sugarcane area was noticed due to various factors including diversion to other lucarative crops. For over a decade Central and Highland region has been dominating sugarcane and sugar production by contributing more than 60% to Vietnam sugar production from sugarcane.

After reduction of sugarcane area in the Mekong Delta, most of the prevailing areas are rain fed in Vietnam and the yields have been fluctuating based on weather from time to time. For last decade the global warming got it's impact on sugarcane production in Vietnam with unpredictable weather patterns and summer temperatures elevated by 1 to 2 deg C with prolonged dry spells. Hence KCP VIL has been investing strongly on irrigation implements in farmer's fields like drip, ponds, borewells, solar pumps, Diesel and electrical pumps sets etc with non refundable subsidies meeting up to 40% of the cost and interest free loans payable in 2 to 3 years. During 2024, a record number of 700 farmers availed investment on irrigation implements. At present around 11% of the

sugarcane area is provided with assured/partial irrigation facilities in the zone invested by KCP VIL.

After recording a peak production of over 1.5 Million tons of sugar per year, Vietnam sugarcane and sugar production faced tough times due to historically worst drought in 2018 and 2019 followed by opening of sugar market from 1/1/2020 to allow sugar imports from ASEAN countries to implement ATIGA. Vietnam sugar production came down to less than 700,000 MTs in the year 2020 and began to gain the momentum after implementation of trade remedies with Anti-Dumping decision in the year 2021 and Anti-Circumvention decision in the year 2022 on the sugar products of Thailand origin. During 2023-24 season Vietnam produced over 1.15 Million Tons of sugar from Sugarcane, a 22% increase over previous year. Currently Gia Lai with 50,000 Ha and Phu Yen with 30,000 Ha are top two provinces holding sugarcane area in Vietnam. Son Hoa where KCP VIL's main plant is located, is the district with highest sugarcane area in Vietnam with 17,000 Ha.

During 2023-24, KCP VIL achieved a crush of 1.345 Million tons of sugarcane the highest achieved over 23 seasons with a sugarcane price of 1,330,000 VND per ton at field for 10% CCS the highest price recorded in the history. It is notable that one farmer achieved an highest average cane price of 1,748,200 VND per ton with an average CCS of 13.4% and one farmer produced 15.3 Tons of sugar/ha the highest production achieved. The plan is to invest around 500 B'VND for 2024-25 season over an area of 26,000 ha against 433 B'VND for 2023-24 season.

Thanks to Phu Yen leadership, the infrastructure system of mountainous districts of the province has developed remarkably. Traffic road system was upgraded with cement concrete or bitument road such as National highway 19C, DT642 and internal road system in communes with sugarcane area under new rural development program. Also investment on lakes for irrigation (e.g: Ky Chau lake in Da Loc commune and Suoi Vuc lake in Suoi Bac commune) created good conditions to improve the sugarcane yield.

Under quality management system FSSC 22000, ISO 14001 for environment management, HALAL certification and SEDEX for supplier ethics and the code of conduct, refined sugar products of KCP VIL with VARELLA brand became popular among beverage and food sectors and continued efforts to improve the technology has brought successful results so far. In the year 2002, only two refined products were introduced to the market and subsequently two more refined products have been introduced to meet varying demands of customers in food and beverage sectors. Nearly 100% of products are being consumed by bulk industrial consumers.

Since establishment, KCP VIL promptly took steps to stabilize the lives of the employees and integrate the business culture with the society by establishing Employees' Trade union in 2003, Communist Party cell in 2010, Ho Chi Minh Youth Union in 2010 and Ex.Soldiers' cell in 2011. KCP VIL also took initiative to its social responsibility with the following.

- Increase the contribution to rural development and social affairs to 5% of the annual profit.
- Setting up of 'Dr.V.L.Dutt-KCP welfare Fund' which owns 15.5% of the legal capital of the company for the welfare of the employees and other welfare affairs in Son Hoa district. At present employees of KCP VIL are being benefitted with around 11 B'VND per year towards Kids' welfare, Children education welfare, family health insurance, support to family in case of high medical expenditure and unfortunate incidents etc.

Over years of contribution to rural development in far and deep mountaneous areas in the most economically backward areas, KCP VIL has been honored with emulation flags and certificates at regular intervals from Province, Centre and Labour Medal of 3rd order and Friendship Medal for Late Dr.V.L.Dutt, Founder Chairman, KCP VIL from Hon'ble President of Vietnam. It is a honor to KCP's activities over three decades that Ms.Kavitha Dutt Velegapudi, Joint Managing Director has been appointed as Honorary Consul for Vietnam in Chennai since Oct, 2022.

With a direction of long-term operation, KCP VIL will continue to initiate action to implement future projects: 100 KLPD Distillery to produce ENA and Fuel Ethanol, expansion of Bio mass power project to 60 MW and expansion of Son Hoa sugar unit to 15,000 TCD with an additional capital of 100 M'USD.

On behalf of the Board of Management and employees, we assure all the stake holders of our continued efforts to meet the aspirations and we sincerely believe that KCP VIL's operation will further elevate growing cooperation and friendship between Vietnam and India. Best wishes to the organisers and delegates of 8th IAPSIT International Sugar Conference ISC-2024 and Sugarcon 2024 and wish the conference will give direction for further innovations in sugarcane and sugar production.

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25 Years of Glorious Journey of Sugar Tech (Springer Nature): Serving the Global Sugar and Integrated industries

The Silver Jubilee of any publication is a delightful moment to look back to the significant historical achievements and also plan towards a better future. The **Sugar Tech** journal (Springer Nature; www.springer.com/journal112355; ISSN-0972-1525) has successfully completed its 25 years of glorious journey. The idea to publish Sugar Tech journal was conceptualized in 1998 at Sugarcane Research Station campus, Kunraghat, Gorakhpur, India. In 1999, the *Society for Sugar Research & Promotion* was registered at New Delhi, India with its major objective to publish an international research journal on sugar c and related industries. Late Mr. Ashok Datta, founder member of Society was very kind enough to provide a office space for the society activities at New Delhi and also took initiative and responsibility of printing the early issues of Sugar Tech journal. His unconditional support will always be remembered. The Editorial Board and Advisory Board were constituted and the first issue (Vol. 1 & 2) was published in 1999, with 10 articles. The Sugar Tech journal became an official publication of Society for Sugar Research & Promotion, New Delhi since 1999 and International Conferences organized by IAPSIT viz. IS-2004, IS-2006, IS-2008, IS-2011, IS-2014,IS-2019 and IS-2022 held at Nanning (China), Guilin (China), Al-Arish (Egypt), New Delhi (India), Nanning(China), UdanThani (Thailand) and Lucknow (India).

In 2008, the global publishing company, Springer, took over the publication of Sugar Tech as co-publisher with four issues a year which was subsequently increased to six issues in 2020 which became breakthrough and a milestone in the journey of Sugar Tech. Ever since we started publishing in association with Springer (Nature) India Pvt. Ltd., Germany, the quality and circulation of the published articles has increased substantially. On time publication of high quality papers during the last two and half decades (1999-2023) was our main priority. Special theme based special issues were also planned to increase the visibility and scope of the journal worldwide. The release of the 2011 journal citation report from Thomson Reuter added to our delight when Sugar Tech fetched its maiden impact factor (IF) of 0.431 and since then there is no looking back. At present, Sugar Tech is published as a peer reviewed bi-monthly research journal, with high quality research articles and reviews on the innovative and eco-friendly technologies related to the sustainability, improvement, production, processing and valorization of sugar crops (sugarcane, sugar beet, sweet sorghum, stevia, palm sugar, etc) and their by products & co-products, aligning with the spirit of SDGs. It is one of the leading journals in the world on sugar crops and ancillary industries with current ISI Impact Factor of 1.8 (2023), over 181000 downloads per year, Scopus h-index of 31 and quartile (Q2) along with circulation in over 130 countries.

The journal is cited in more than sixty international citation services, with ISI Thomspon Reuters, SCOPUS, Google Scholar, INSDOC, Elsevier Biobase, Dimensions, Indian Science Abstracts, SCImago, Science Citation Index, Expanded,

Chemical Abstracts Service (CAS), Google Scholar, AGRICOLA, CAB Abstracts, CNKI, Current Contents/ Agriculture, Biology & Environmental Sciences, EBSCO Discovery Service, Elsevier Biobase, EMBiology, Expanded Academic, Japanese Science & Technology, OCLC WorldCat, Pro Quest, Meta, Naver, OCLC World Cat Discovery Service, Portico, Wanfang etc. The high IF has also led to a dramatic increase in the number of international submissions, from more than 75 countries worldwide. It is encouraging to see Sugar Tech articles being cited by the major internationally recognized high Impact journals and many other publications, reflecting its high standard and content of the research publications (www.springer.com/journal112355).

The great success of *Sugar Tech* would not have been possible without the crucial and valuable support of the Society for Sugar Research & Promotion (SSRP), New Delhi and International Association of Professionals in Sugar & Integrated Technologies (IAPSIT), Nanning, China. The editors, advisory and executive board members, reviewers and authors are the real strength who constantly ensured the quality standard of the papers being published. We would like to extend our sincere thanks to all those who have helped in sustaining the quality and ensuring timely publication of all the issues and also look forward for this supporting spirit in the coming years too. We would also like to thank Springer Nature Pvt. Ltd. for co-publishing Sugar Tech, which has become a milestone for recognisation and acceptance of the journal to worldwide audience.

We are grateful to our editors, authors, society members, Springer team, advisory team and society staff for facilitating the journey of Sugar Tech from a hard copy format to an online platform of international standards, thereby disseminating scientific contents to a global audience. The Sugar Tech with the support from Springer Nature has been making rapid and consistent progress since 1999. We are hopeful that Sugar Tech will reach the pinnacle of expectations of authors working in the area of sugar crops, sugar processing, technologies, bioenergy and by-products etc. Currently, a large number of articles published in Sugar Tech journal address social, environmental, and economic issues related to the SDGs.

After 2010, two special issue were published with the theme *Innovation for Sustainability of the Sugar Agro-Industry* (March-April, 2022) and Diversification of Sugar Crops for Value Addition (Nov-Dec, 2021). These issues highlight the shared vision for a sustainable global sugar industry as well as mapping SDGs related interdisciplinary research priorities to broader the global collaboration and partnership.

The sustainability strategy is an inherent part of business plan and consistent with the commitment to contribute to the society. Articles where sugar mills have adopted suitable bio refinery model using agro-feedstock essentially sugarcane and its derivatives to produce ethanol and bagasse based biochemicals, bioplastic, specialty sugars/chemicals are priority areas of our publication. These bio-based chemicals have applications in a wide array of industries and we are getting excellent feedback from many countries.

So far the Sugar Tech has published more than 2000 articles including research articles, reviews, short communication, scientific correspondence, opinion, editorials and news. Sugar Tech has published 12 special issues in last 25 years. The journal has currently JCI rank of 42/125 among top most Agronomy journals with quartile Q2, H Index 41, SJR 2023 0.45 and JCI percentile 66.80 in 2023. The total number of cites for Sugar Tech was 4749 and the 5 years' IF is 1.8 in 2023.

Sugar Tech promotes the shared vision of UN 2030 SDGs and encourage its contributors to publish articles on various socio-economic issues related to sustainability

IS 2004, Nanning, China


IS 2011, New Delhi, India


IS 2006, Guilin, China


IS 2022, Lucknow, India


IS 2008, Al-Ahrish, Egypt


IS 2006, Guilin, China

IS 2011, New Delhi, India


IS 2011, New Delhi, India

IS 2008, Al-Ahrish, Egypt


IS 2006, Nanning, China

Glimpses of International Sugar Conferences


IS 2022, Lucknow, India


IS 2008, Al-Ahrish, Egypt

IS 2018, Udon Thani, Thailand

IS 2004, Nanning, China


IS 2022, Lucknow, India


Sugar Tech journal release at SSRP Office, New Delhi


IS 2011, New Delhi, India


IS 2011, New Delhi, India

IS 2018, Udon Thani, Thailand


IS 2006, Nanning, China

Glimpses of International Sugar Conferences

of sugar and integrated industries. A good number of reviews are published on CSR and SDGs as the sugar industry also fulfils its Corporate Social Responsibilities leading to the overall betterment of its stakeholders. This has enabled the sugar industry to align itself with the 2030 Agenda for Sustainable Development Goals and Sugar Tech journal is actively promoting these issues through its reviews and research papers. The CSR activities of sugar companies are focused on different sectors with main emphasis on promotion of education, health care, drinking water & sanitation, gender equity and empowering women.There is ample scope in our publication for these socio-economic topics.

In view of the growing importance of sugarcane varieties in sustaining global sugar industry, a special issue was published on the *History of Sugarcane Breeding, Germplasm Development and Related Molecular Research* (Jan-Feb, 2022). This is for the first time that a detailed and comparable information about sugarcane genetics and breeding updates from all the major sugarcane producing countries were brought together. This issue is a valuable repository for the breeders, scientists, industry investors, technologists and students involved in sugarcane improvement programme all over the world. Besides, we have published twelve several special issues on different emerging themes on sugar crops and industry. All the issues of Sugar Tech are being published well in time with a special focus on improving the quality of articles that are being published.

On this historic occasion we are glad to bring out Silver Jubilee Special Issue on *Sustainability through Diversification in the Sugar Industry*, to be released at the time of 8th IAPSIT International Sugar Conference & Sugarcon-2024 in Quy Nhon, Vietnam.

Besides publication of scientific articles related to sugar and integrated industries, Sugar Tech journal has also promoted various conferences especially those organized by IAPSIT and SSRP. Our journey of excellence with Sugar Tech started in 2004 with the International Symposium on Sustainable Sugarcane and Sugar Production Technology held at Nanning, from 29th November to 2nd December, 2004. This was a memorable event in the history of Chinese sugar industry, in which 270 delegates from 20 countries participated. Since, then the Sugar Tech journal became an official publication several International Conferences organized by IAPSIT viz. IS-2004, IS-2006, IS-2008, IS-2011, IS-2014, IS-2019 and IS-2022 held at Nanning (China), Guilin (China), Al-Arish (Egypt), New Delhi (India), Nanning (China), UdanThani (Thailand) and Lucknow (India). Here, we would to acknowledge especially the immense support of Prof Yang rui-Li , Guangxi Academy of Agricultural Sciences, Nanning, P.R. China in promotion of Sugar tech journal and organization of IAPSIT Conferences. Sugar Tech association with the IAPSIT and SSRP conferences (listed below) was especially helpful in promoting inter-institutional & Industry-academia collaboration at global level.

- 1st IAPSIT International Conference IS-2004, Nanning, P.R. China
- 2nd IAPSIT International Conference IS-2006, Guelin, P.R. China
- 3rd IAPSIT International Conference IS-2008, Al-Arish, Egypt
- 4th IAPSIT International Conference & Expo IS-2011, New Delhi, India
- 5th IAPSIT International Sugar Conference-IS 2014, Nanning, PR.China
- 6th IAPSIT International Conference-IS 2018, Udon Thani, Thailand
- Sugarcon- 2019 International Sugar Conference, Lucknow, India
- 7th IAPSIT International Sugar Conference IS-2022 & Sugarcon-2022,Lucknow, India

As Editors-in-Chiefs of Sugar Tech till 2023 and Executive Chief Editors at present, it becomes our moral responsibility to ensure continuity of the activities of Sugar Tech and SSRP/IAPSIT with greater zeal and dedication. We would like to thank our eminent editorial board members round the world, who have been instrumental in supporting the editorial activities of Sugar Tech. On behalf of the SSRP, we welcome all the delegates to ISC-2024, Quh Nhon, Voetnam from September 16-19, 2024 and hope that you will continue to patronize **Sugar Tech** for publishing your valuable research and review articles. Our sincere greetings and thanks to the esteemed contributors, readers and the publisher.

G. P. Rao, Chief Executive Editor

S. Solomon, Chief Executive Editor

www.ssrpglobal.net, www.springer.com/12355

SSRP
8th IAPSIT International
Sugar Conference ISC-2024
Quy Nhon, Vietnam

Plenary Lectures

IS-2024
Vietnam
www.isc2024.com

PLENARY LECTURES

PL-01

Breaking sugarcane productivity plateau in ASEAN region under changing climate scenario: Are we heading in the right direction?

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Sugarcane is grown currently in eight ASEAN countries. They all enjoy tropical climate, however, it is becoming increasingly erratic with extreme weather events recurring frequently. In 2022, sugarcane was grown in 2.8 Mha in ASEAN countries collectively, producing 172.8 Mt of sugarcane. The average cane yield in the region in 2022 harvest season was estimated to be 53 t ha^{-1}, which ranged from 20 t ha^{-1} in Malaysia to 66 t ha^{-1} reported in Vietnam, Indonesia and Myanmar. Historically, as with most developing countries, sugarcane farms in ASEAN region are typically small farm holdings, rainfed, manually harvested, and with relatively low input and crop productivity. With the exception of Philippines, all ASEAN countries produced less than 10,000 ha of sugarcane till 1970. Since then, area of cultivation expanded in all sugarcane growing ASEAN countries at varying degrees but none of them crossed 0.5 Mha till now, except Philippines for a brief period of in the mid-seventies, and Thailand, which grew relatively rapidly until lately. Thailand became the largest sugarcane growing country in ASEAN by early 1980s and it continued to grow till early 2020s, with harvested area reaching 1.52 Mha in 2022. Indeed, in the last 30 years area of sugarcane cultivation remained either static or declined in all ASEAN countries except in Thailand. However, there is an effort to increase sugarcane production in Indonesia lately.

Contrary to production area, cane yield variation among ASEAN countries in the early sixties was remarkably large with Indonesia recording as high as 137 t ha^{-1} followed by Cambodia harvesting 76 t ha^{-1}. The high cane productivity of Indonesia was maintained till mid-eighties and then plateaued. In general in the last three

decades cane productivity trend in ASEAN region showed a mixed response with some countries showed weak upward trend, some remained more or less unchanged and Malaysia recording a dramatic decline. From a global sugarcane industry perspective, it is worth noting that the average cane yield in most ASEAN countries remained below global average of nearly 120 sugarcane growing countries for the past three decades at least.

Significantly, all ASEAN countries conduct sugarcane breeding trials, mostly by government institutes, and over the last six decades a large number of varieties, either locally bred or imported, were released with a relatively limited impact in cane productivity. Understandably, and rightly, all sugarcane research institutions in the region give high priority to breeding. However, given the rising annual ambient temperature and extreme adverse weather events as occurred lately in the regions, breeding for more productive varieties is going to be increasingly challenging, technically demanding and risky. This situation is further exacerbated by the declining resources and the technical capacity for modern plant breeding currently experiencing in the region. Hence, a transformative shift in variety development is imperative to deliver highly productive and climate resilient varieties. However, considering the limited government resources, the relatively low private investment, and the increasingly uncertain geopolitics in the region, it remains unclear how fast and how far the regional sugarcane breeding systems can be transformed to make a meaningful boost in sugarcane productivity in a commercially acceptable timeframe. This is further compounded by small farm holdings, sub-optimal cropping system, soil degradation, limited farm mechanization, poor extension systems and shrinking human resources widely occurring in the region. With this backdrop, possible options, strategies and technologies to accelerate variety development, improve cropping system and boost sugarcane crop productivity under changing climate are discussed.

PL-02

Sugarcane industry: A possible bio-energy hub

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India has emerged as the second-largest producer and biggest consumer of sugar globally. The Indian sugar industry comprises more than 500 operational sugar mills as of the 2023-24 season, with approximately 350 integrated distilleries, 300 co-generation plants, and several ancillary units. It aims to achieve economic and environmental sustainability through the production of clean and green energy. This includes bio-electricity from bagasse-based co-generation plants, bio-ethanol from molasses, cane juice, or other process intermediates, and compressed bio-gas from filter cake, press mud, and other agricultural residues.

The Indian sugar industry, along with sugar industries in other countries, now recognizes that molasses and bagasse can no longer be considered mere by-products solely for primary sale. Hence, there is a serious investigation into value addition, diversification, and integration with other industries to explore new markets and reduce dependence on sugar as a single commodity. The future of the sugar industry lies in transforming sugar factories into sugarcane bio-refineries. This involves producing bio-electricity, bio-ethanol, bio-gas/compressed bio-gas, other bio-fuels, including green hydrogen, and other bio-products, thereby fully exploiting the sugarcane value chain.

Sugar industries worldwide must adopt flexible business models tailored to local conditions and product mixes. With increasing focus on "global warming," "climate change," and achieving "carbon neutrality," the role of the sugar industry in providing clean, green, and renewable energy becomes paramount. The commitment of various nations, as indicated in COP 28 and through informed timelines for carbon neutrality ranging from 2040 to 2070, underscores the importance of clean energy production by the sugar industry. This not only helps in achieving environmental goals but also generates additional revenue streams, reduces dependency on sugar revenues, and enhances economic sustainability.

India has already demonstrated leadership by generating power from bagasse, producing ethanol from sugarcane juice, syrup, and molasses intermediates, thereby transforming the landscape of sugar production. Ethanol production, in addition to its other benefits, has stabilized the sugar demand-supply scenario and maintained stable sugar prices. The country is now scaling up production of compressed bio-gas and exploring various options for producing "green hydrogen," which is seen as a fuel for the future.

PL-03

Building a resilient & sustainable Philippine sugar and bioenergy industry

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Sugarcane is a traditional crop of the Philippines with a total plantation size of about 390,000 hectares that sustains the livelihood of more than 90,000 sugarcane farmers and about 700,000 field and industrial workers.

In the past, sugar was the only main product from sugarcane but upon the passage of the bioenergy laws (Biofuels and Renewable Energy Laws) in the Philippines which incentivized and provide safeguard measures for locally-produced bioethanol and biopower derived from sugarcane-based feedstocks, the sugarcane industry has transformed into a 3-legged industry with sugar, bioethanol and biopower as major products. In the year 2024, twenty-five (25) sugar mills, ten (10) sugar refineries and thirteen (13) bioethanol plants are operating while fourteen (14) biopower plants are awarded with certificates of commerciality by the Philippine Department of Energy having a total installed capacity of 362 megawatts (MW).

In 2015, the Sugarcane Industry Development Act (SIDA) was passed which provides mandated appropriations of major programs that are envisioned to build resiliency and ensure the sustainability of the Philippine sugarcane industry. Research, development and extension (R, D & E) is one of the five (5) major programs under SIDA where the Philippine Sugar Research Institute (PHILSURIN) plays a major role as the private sector partner of the sugarcane industry in the breeding and distribution of high-yielding and climate-resilient varieties. Around 61% of the total sugarcane plantations is planted with PHILSURIN varieties, however, the performance of old varieties has declined over the years and became susceptible to diseases. In order to beat the challenges of declining agricultural productivity, PHILSURIN is working to partner with government in the establishment of seed farms and distribution of new high-yielding and climate-resilient sugarcane varieties.

In line with the Sustainability Development Goals (SDGs) of the United Nations (UN), social benefits are provided to sugar and biofuel workers through the Social Amelioration and Welfare Program of the government. Programs for the workers on livelihood, healthcare, education, protection against child and forced labor are implemented and funded through the government in partnership with the private sector.

Low agricultural yields of sugarcane farms in the Philippines are influenced by climate change, farm financing, farmers practices, sugarcane varieties, depleted and highly acidic soil and fragmentation of farms due to the agrarian reform program. Shifting to regenerative agriculture practices, adoption of new farming technologies and organizational strengthening measures of industry organizations are key initiatives that will build the resiliency and sustainability of the Philippine sugarcane industry.

PL-04

Sustainability of sugar business: Efficiency and diversification

Sanjay Awasthi

President, The Sugar Technologists' Association of India
Chairman ,ISSCT
Chief Executive, Isgec Heavy Engineering Ltd.

25 years ago when margins were good and sugar business was profitable, so other revenue streams of by-products were neglected. Sugarcane is a political crop rising it's prices by every crushing season which reversed the profit scenario of sugar business. Profits can only gained and sustained by in-house savings and diversification of sugar business. Savings triggered the thoughts for various efficiencies e.g. RME, PI, RBHR, energy saving ,reducing waste, and utilizing resources effectively to maximize yield and profitability. Diversification opened the door to find the various routes to gain profit from by-products of sugar industry, expanding product lines, exploring alternative markets, and integrating innovative technologies. Sugar business through efficiency and diversification is aiming to create a robust, future-proof industry. By focusing on these aspects, the sugar industry can mitigate risks associated with market volatility, climate change, and resource scarcity. Agricultural development, process and technological improvement from sugar industry 1.0 to 4.0, energy security and energy management from conventional equipment to energy saving machinery, diversified product basket from double sulphitation to various varieties of sugar, exploring new routes to utilize by-product potential, decarbonization are the sustainability drivers.

PL-05

Role of Vietnam Sugarcane and Sugar Association (VSSA) on the sustainable development of sugar industry in Vietnam

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Vietnam Sugarcane and Sugar Association (VSSA) a social professional organization of Vietnamese citizens is operating in the field of sugarcane and sugar production and working towards the holistic development of farmers and the industry. VAAS is actively involved in improving the income of sugarcane farmer by implementing synchronously solutions to improve productivity, quality, and reduce sugarcane production costs: seeds, mechanization of sugarcane planting and harvesting, investment in irrigation and transportation infrastructure to augment productivity and production. It is also involved in export promotion and improve sugarcane farming techniques. Besides VSSA is also streamlining efforts to Establish fair environment for sugarcane & sugar production, promoting official sugar export, at the same time aiming to reduce Smuggling of sugar.

As a result of consistent efforts by VSSA, farmers , industry and Government, in Sugar Season 2023-24 sugarcane production reached 10,953,406 tons, producing 1,147,498 tons of sugar. As Compared to the 2020-21 season, sugarcane crushing output reached 163% and sugar output by 166%. Viet Nam sugar industry is prone to many biotic and abiotic stresses. Viet Nam is part of Southeast Asia, one of the most vulnerable regions to climate change, and faces rising sea levels, heat waves, floods and droughts,and increasingly intense and unpredictable weather events. The major sugarcane production areas of Viet Nam are facing recurrent drought, flooding, forest fire leading to decline in cane production.

Based on the request of VSSA, Viet Nam Government launched investigations and finally approved trade defense measures to protect the local sugar industry viz. payment of higher sugarcane price to farmers than sugarcane production cost (50 – 60 USD/ton). In five consecutive crop years, sugarcane purchasing prices have continuously increased by a total of 150%. Now, farmers have restored confidence in sugarcane, and as a result sugarcane area in 2023-24 crop year increased by 127% compared to the 2021-22 crop year.

PL-06

Diversification opportunities for sugar companies amidst maturing bioeconomy

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Digital agriculture (DA) integrates technologies ranging from close-range environmental sensors to aerial systems, all underpinned by the Internet of Things (IoT). This transformation of traditional agriculture into data-driven smart farming promises substantial benefits in efficiency, effectiveness, and productivity. DA heavily relies on data collection from diverse sources, managed and analyzed in agricultural data warehouses, drawing on principles from data science. However, farmers transitioning to DA encounter significant challenges. Reliable high-speed networks are essential for collecting and processing data to optimize farm management practices, yet poor connectivity in rural areas remains a major obstacle. Moreover, leveraging DA effectively often requires farmers to assume roles akin to data scientists, adding complexity. Robust cybersecurity measures are also crucial but come with associated costs. Agricultural operations involve multifaceted elements—soil management, agronomy, crop protection, weather, and labor—making informed decision-making complex. Data supporting crop production is voluminous, complex, and heterogeneous, necessitating sophisticated analysis. Balancing the relevance of different parameters, such as soil moisture versus structure, or the seasonal impact on their weighting, is critical. Similarly, determining the priority between metrics like normalized difference vegetation index (NDVI) and plant height poses challenges. Furthermore, while DA promises substantial rewards, there is a concern about potentially overshadowing farmers' experiential knowledge of local ecosystems with technocratic expertise. This shift raises questions about how to blend these insights effectively. This paper examines the challenges hindering the widespread adoption of smart farming practices and explores potential solutions to overcome these barriers.

PL-07

Safeguarding sugarcane cultivation from insect pests through biocontrol and other compatible technologies in ASEAN countries vis-à-vis India

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Sugarcane has become increasingly important in the agriculture of India and ASEAN countries due to its profitability and the growing demand for sugar products. India is the world's second-largest producer of sugarcane, following Brazil, while Southeast Asian countries contribute approximately 8% of global sugarcane production. However, sugarcane cultivation faces significant challenges from biotic stresses, particularly insect pests and diseases, which are major constraints in achieving higher productivity. More than 400 insect pests and diseases are associated with the sugarcane crop from germination to harvest. Of these, around two dozen insect pests and a dozen diseases cause substantial economic losses. Globally, the most damaging insect pests of sugarcane belong to orders such as Lepidoptera, Hemiptera, Coleoptera, Orthoptera and Isoptera, with lepidopteran borers alone causing 10-30% crop damage in most of the sugarcane-growing regions. It is estimated that insect pests and diseases result in a 20-30% reduction in sugarcane yield. These pests and diseases affect both the subterranean (below ground) and aerial (above ground) parts of the plant. Sugarcane is increasingly recognized as a multi-purpose crop, serving sectors ranging from food and pharmaceuticals to energy production. The expansion of sugarcane cultivation for various purposes has thrown new challenges of pests' movement from one region to other. Therefore, improving and adopting effective pest management strategies is crucial. To manage insect pests effectively, an integrated strategy that includes regulatory, cultural, mechanical, biological, behavioural, and chemical control methods is essential. Given that sugarcane is a semi-perennial crop, various biocontrol agents—including parasitoids, predators, and entomopathogenic microbes (such as fungi, bacteria, baculoviruses, and nematodes) and its compatible technologies including semiochemicals have proved effective against a range of insect pests. In order to enhance sugarcane productivity and farmers' income without compromising the harmony of ecosystem, it is imperative to adopt biological control and its compatible technologies for effective management of insect pests in ASEAN countries vis-à-vis India. The present paper, throws light on strength of non-pesticidal approaches in overcoming the pest problem in sugarcane cultivation and possible collaborations amongst various stakeholders in ASEAN countries vis-à-vis India.

PL-08

Modern sugarcane varietal improvement – Indian perspective

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India is the world's second-largest producer of sugarcane. Major breeding objectives include developing varieties to optimize sugar and bioethanol production across diverse agro-climatic regions. A century-old breeding program has yielded remarkable varieties that transformed India from a sugar deficit to surplus producer. To mitigate climate change impacts and resist major diseases, varieties with broader adaptability, shorter duration, and ability to ratoon multiple times are crucial. Fiber, lignin content, and biomass have also become integral to modern breeding efforts. Strategic utilization of genetic resources can expedite the incorporation of beneficial traits into commercial sugarcane varieties. The successful integration of *Erianthus procerus* for combining red rot resistance and drought tolerance, harnessing the antioxidant-rich *S. robustum sanguineum* through breeding for enhanced biomass, and commercialization of energy canes as biofuel feedstock in public-private partnerships (PPP) add substantial value to Indian breeding initiatives. Marker-assisted selection and genomic selection enhance precision in selecting complex traits. India aims to achieve 100 tons/ha by 2047 AD, emphasizing expanded screening and pre-breeding of potential germplasm through accelerated flowering induction, speed breeding, and phenomics to develop resilient varieties for diverse stress conditions. AI tools are being introduced for efficient selection to optimize resource use. Genetic transformation and genome editing tools are currently employed to engineer sugarcane plants with improved stress tolerance, altered sugar profiles, and for novel applications such as pharmaceuticals, vaccines, and bioplastics. Bagasse is also engineered for second-generation (2G) ethanol production by modifying lignin components. Collaborations with stakeholders are opening new avenues for dynamic growth in sugarcane agriculture and agro-industry. Encouragingly, the Indian Sugar Mills Association is collaborating with research institutes to evaluate new varieties across multiple environments to expedite varietal adoption.

PL-09

R&D imperatives for the Vietnam sugar industry in the integration period into the Asean sugar sector

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The Vietnam sugar industry plays a significant role in the country's agricultural sector and economy. Traditionally, sugarcane cultivation and sugar production have been vital components of Vietnam's agricultural landscape, providing employment opportunities and contributing to rural development. However, in recent years, the Vietnam sugar industry has faced challenges such as declining production, import dependency, and market liberalization, it also possesses strengths and opportunities for growth and revitalization. Research and Development (R&D) initiatives play a crucial role in advancing the Vietnam sugar industry and fostering its integration into the broader ASEAN sugar sector. By prioritizing strategic R&D imperatives, Vietnam can not only enhance its own sugar industry but also contribute to the overall development and competitiveness of the ASEAN sugar sector.

1. Enhancing Agricultural Productivity: Investing in R&D to improve sugarcane varieties, agricultural practices, and technologies can significantly boost yield and quality in Vietnam. These advancements not only benefit local sugar producers but also contribute to increased sugarcane productivity across the ASEAN region, thereby strengthening the overall supply chain and competitiveness.

2. Sustainable Farming Practices: R&D efforts focused on sustainable farming practices, such as precision agriculture, water management techniques, and organic farming methods, can mitigate environmental impact and promote resource efficiency. Implementing these practices in Vietnam sets a precedent for sustainable sugarcane cultivation within ASEAN, fostering environmental stewardship and long-term viability for the entire sector.

3. Innovative Processing Technologies: Research into innovative processing technologies and equipment tailored for the Vietnam sugar industry can enhance efficiency, reduce energy consumption, and improve product quality. Sharing knowledge and best practices within ASEAN facilitates technology transfer and adoption, driving modernization and competitiveness across the regional sugar sector.

4. Value-Added Product Development: R&D initiatives focused on diversifying product offerings and developing value-added sugar-derived products align with ASEAN's goals for economic diversification and industrial growth. By innovating new products such as specialty sugars, biofuels, and biodegradable plastics, Vietnam contributes to expanding the market potential and revenue streams for the entire ASEAN sugar industry.

5. Climate Resilience and Adaptation: Researching climate-resilient sugarcane varieties and adaptive farming practices helps mitigate the impact of climate change on sugar production in Vietnam and the broader ASEAN region. Collaborative R&D efforts to develop weather-resistant crops and predictive modelling tools strengthen the sector's resilience to climate-related challenges and ensure food security for the region.

6. Market Intelligence and Trade Optimization: R&D capabilities in market intelligence, trade analysis, and consumer trends enable Vietnam to identify export opportunities and optimize trade strategies within ASEAN and beyond. By understanding market dynamics and consumer preferences, Vietnam contributes to the collective growth and market expansion of the ASEAN sugar sector.

7. Capacity Building and Collaboration: Investing in R&D capacity building and fostering collaboration among stakeholders, research institutions, and industry players strengthens the knowledge base and innovation ecosystem within Vietnam and across ASEAN. Collaborative research networks facilitate technology exchange, skill development, and collective problem-solving, driving sustainable growth and competitiveness regionally.

By prioritizing these R&D imperatives, the Vietnam sugar industry can strengthen its competitiveness, foster sustainable growth, and contribute to the overall development of the ASEAN sugar sector.

PL-10

Green technologies to manage sugarcane diseases in Asian countries

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Sugarcane is popularly grown in different countries like India, China, Thailand, Pakistan, Vietnam, Indonesia, Bangladesh, Iran etc. The crop productivity remains static across the countries and it is challenged by various biotic and abiotic constraints. Among the biotic constraints, different diseases caused fungi, bacteria, virus and phytoplasma impact sugarcane production and productivity to varying levels in different countries. Epidemics of fungal diseases like red rot, smut and wilt and crop losses are common in many of the counties. Phytoplasma diseases, grassy shoot disease (GSD) and white leaf disease (WLD), bacterial diseases, ratoon stunting (RSD) and leaf scald (LSD) and viral diseases mosaic, yellow leaf disease (YLD) and leaf fleck seriously affect the crop in most of the Asian countries. Recently, twisted top (pokkah boeng) and rusts have become major diseases across the countries and affect cane production. Disease management has been a challenging in sugarcane mainly due to different causative agents, carry over of the pathogens through planting materials, ratooning practices, limited scope of chemical applications, large volume of initial planting materials etc. In addition, systemic accumulation of non-fungal pathogens causes 'varietal degeneration' by which vigour of the elite varieties are lost and productivity is reduced in the field and we are unable to harness the real yield potential of them. Adopting resistant varieties is the main stay in disease management in sugarcane, however resistant sources are not available for many diseases especially, GSD, YLD, LSD, RSD, mosaic, leaf fleck, rust and other diseases or research efforts were not made in this area. Hence there is a need to focus on host resistance to major diseases in sugarcane. Biocontrol approaches offer scope in managing the fungal diseases in sugarcane. Application of tissue culture has proved very effective in producing disease-free planting materials including the viruses. Here, precise molecular diagnostics ensure total freedom of the pathogens in the seedlings. Although heat treatment is not completely effective, proper handling of the system will reduce the pathogen load significantly under field conditions. Improved delivery of chemicals and bioagents through mechanized delivery efficiently manages fungal diseases in sugarcane. Recently, application of AI and IoT based technologies have emerged to monitor diseases in the field and disease management. Overall, to sustain sugarcane productivity these green technologies are to be adopted to reduce the impact caused by the diseases.

PL-11

Current trends and transitions in Thai sugarcane production: From burnt cane to green cane

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Thailand's sugarcane industry plays an important role in the nation's agricultural sector. Following the difficult sitations in the past several years, e.g. drought, flood, labour shortage. Thailand sugarcane production fluctuated in the range from 134 million tons cane to 65 million tons. With the present global concern on environment, the burned cane in Thailand then becomes the challenging obstacle to overcome. Several policies from government have been used to reduce the burnt cane in the past few year with some success. However, to achieve the over all green cane, some more efforts have to be applied from all the parties: government, sugar mill as well as farmers. With the implementing of the Bio-Circular-Green (BCG) economic model and new technolgy on smart farm, the prospect of increasing of green cane becomes much clearer. This will lead to the sustainble future for Sugarcane industry in Thailand.


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TH-01

Development of sugar industry in China: R & D priorities for sustainable sugarcane production

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This paper introduces the status of the sugar industry in China, focusing on the production of sugarcane, sugarbeet, and sugar, as well as achievements in sugarcane breeding, farming technology exploitation, and value-added byproduct development. In recent years, China has cultivated approximately 1.6-1.8 million hectares of sugar crops and produces about 9-11 million tonnes of sugar, with approximately 85-91% derived from sugarcane. Guangxi is a major producer of cane and sugar, contributing about 60-70% of the national total. The production of sugarcane and cane sugar has seen a significant decline over the past two milling seasons, particularly in Guangxi, due to prolonged severe drought during the fast-growing season, resulting in a substantial reduction in cane sugar and total sugar production. However, beet sugar production has rebounded to levels seen a decade ago. The sugarcane planting area remains relatively stable, particularly in Guangxi, compared to sugarbeet production. Sugar recovery has improved in recent years due to significant advances in sugarcane breeding and new technology development. Currently, elite sugarcane varieties GT42 and GL05136 cover 28.66% and 28.48%, respectively, of China's total sugarcane growing area in 2023. Other major sugarcane varieties include GT44, GT46, GT49, GT55, GT58, YT93-159, YT55, YZ05-51, YZ08-1609, among others. Domestically bred sugarcane varieties accounted for over 95% of the total sugarcane growing area in 2023, with more than 80% originating from Guangxi. GT varieties dominate the sugarcane planting area in China. Drought remains the primary abiotic constraint for sugarcane production. Meanwhile, smut and borers continue to pose significant biotic challenges. Production costs need to be reduced, and machine harvesting remains unpopular. Research and development priorities for sustainable sugarcane production in China include creating elite parent lines using wild germplasm, breeding high-yielding, high-sugar, disease-resistant, and nitrogen-efficient sugarcane varieties with strong ratooning ability through conventional and biotechnological approaches, promoting the commercial availability of healthy seed cane for millable cane production, developing mechanized field management techniques, especially for harvesting, and implementing low-cost, efficient cultivation technologies for sugarcane production.

TH-02

Mechanisation and sugarcane production in Fiji

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Similar toother sugar producing countries, sugarcane was thekey revenue earner and major contributor of Gross Domestic Product (GDP) for Fiji in 1990s. Sugar sector generated FJD$276.1min export earnings in 1995, which further increased to $301.7m in 1996. 4.4 million tonnes of sugarcane and 454,000 tonnes of sugar was produced in 1996by over 20,500 active farmers and contributed to around 10-12% of GDP. The performance of the industry is however diminishing. While 20 percent of the population still rely on the industry both directly and indirectly, production has declined. There are now 16,926 registered cane growers; however, only 10,872 are actively supplying cane. In 2022, revenue generated from sugar was only $169.2m with less than 1.5%contribution to GDP. 1.6 million tonnes of sugarcane and 156,000 tonnes of sugar was produced in 2022.Numerous challenges have attributed to the deteriorating production.Lack of laborers both for cane harvesting and cane cultivation coupled with aging farmers is a major reason for decline in cane production. Government together with industry stakeholders have resolved that mechanization would ease burden of labor shortage and bring efficiency in cane cultivation and harvesting. Since 2017, Government has assisted 51 co-operatives to procure mechanical harvesters. With such initiative, the industry has achieved nearly 40% of the cane mechanically harvested with a total of 95 mechanical harvesters. The industry is also venturing into service providers and achieved over 100 service providers to be hired by farmersto assist in cane cultivation and land preparation. To further improve efficiency, the Government will be procuring 16 fertiliser applicators and 12 cane planters to assist in cane cultivation. Efforts are ongoing to venture into AI technologies such as drones to bring efficiency and industry's future sustainability.

TH-03

Advance to the next level of molecular breeding in Canal Point, Florida

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The sugarcane breeding program in Canal Point (CP), Florida is designed to develop high-yield and disease-resistant cultivars for two soil types (Muck and Sand soils). The key objectives of this program are to enhance sugar yield, high biomass, efficient ratooning ability, disease resistance, and abiotic tolerance. Although biomass production has increased sufficiently, sugar content is going downward. Current phenotype-based conventional breeding has some limitations in breaking through this negative relation between biomass and sugar yield along with satisfying other critical objectives. Thus, the sugarcane molecular program in CP has been designated to explore advanced molecular breeding techniques, being used in many crops to successfully improve many trait values simultaneously, such as to identify gene and genomic regions along with associated molecular markers for key disease resistance, sugar, ratooning ability, and yield-related traits to facilitate selection using molecular markers physically associated with superior alleles of traits that will result in *Saccharum* genotypes with improved traits of interest. To achieve the goals of the molecular program, various techniques including quantitative trait loci (QTL), genome-wide association study (GWAS), genomic selection (GS), transcriptome analysis, and high throughput phenotyping techniques are being explored successfully. Among the most noteworthy accomplishments is discovering diagnostic molecular markers (G1 and M16) associated with orange rust resistance. Results showed that the G1 marker could effectively identify orange rust-resistant germplasm with 85.6% accuracy. QTL associated with brown rust resistance suggested that other sources of genetic resistance are present in the CP breeding materials along with the *Bru1* locus. The prediction accuracies for brown rust resistance ranged from 0.28 to 0.43 regardless of five testing GS models and the prediction ability further improved by including a known major locus (*Bru1*) for resistance to brown rust as a fixed effect in the model. Additionally, it significantly lowered the training population size and minimum number of markers needed for GS. The results of the nonparametric GS models were better than those of the parametric GS, indicating that genomic sources driving the resistance reaction may be nonadditive genetic

effects. In another study, the trends of prediction accuracy for seven sugar and yield-related traits were similar for all three crop cycles (ranging from 0.11 to 0.37) across seven GS models. RKHS and ADE outperformed the other models across all traits and crop cycles. The prediction accuracy was highest for stalk weight (0.37). Eight novel nonredundant single-nucleotide polymorphism (SNP) markers and six potential quantitative trait loci were linked to all five evaluated ratooning ability traits. The five ratooning ability traits were linked to seven potential candidate genes. The traits that were evaluated had intermediate genetic prediction accuracies, ranging from 0.21 to 0.36. Our findings suggest that GS is possibly a new direction for improving disease resistance, ratooning ability, sugar, and yield-related traits in sugarcane, and advancing our breeding program.

TH-04

Genome editing for the sustainable improvement of sugarcane

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The breakthrough gene-editing technology, especially CRISPR-Cas9, offers significant opportunities to revolutionize sugarcane's potential as a sustainable crop for future energy sources. Gene editing technologies provide precise tools for manipulating the sugarcane genome to improve specific traits. These technologies allow for simultaneous editing of multiple targets, base editing with single nucleotide precision, and selective activation or repression of gene expression. Strategies being explored for sugarcane include targeting yield, haploid induction, altering flowering behavior, improving abiotic stress tolerance, and enhancing sugar content through gene editing. Additionally, microbial genetic modification through gene editing facilitates the conversion of sugarcane biomass. We have developed a multiple cloning strategy for generating sgRNA/Cas9 vectors targeting the sugarcane flowering locus and haploid-inducing genes in sugarcane. These targeted modifications hold promise for developing resilient, high-yielding hybrids. Advances in gene editing technologies are also paving the way for transgene-free editing systems, which could simplify the regulatory processes for the release and commercialization of gene-edited crops worldwide.

TH-05

Research and development prospects for sugarcane industry in Vietnam

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Sugarcane is one of the most important industrial crops in Vietnam and covers a total of 127,000 hectares of plantation area. In the season 2020–2021, Vietnam has produced 0.763 million tons of sugar (accounting for 0.34% total world sugar production). A current sugarcane production of 7.498 million tons is being used mainly for sugar production for direct consumption, ethanol production, bio-electricity and fertilization. To ensure crop sustainability, various policies and plans have been implemented. Crop breeding and zoning improvement programme significantly influence sugarcane production and sugar yield. Over 25 years since the programme "one million ton of sugar" was promoted, Vietnam currently possesses 25 sugar mills with a total capacity of 110,000 tons of sugarcane per day. Major problems of sugarcane industry as well as research and development have been discussed in this review. Recent research and development work focused on the added values of co-products to ensure sustainability of the sugarcane industry. Molasses will be used for ethanol production, and bagasse is used as the biomass for the alternative energy. Sugarcane and sugar would be the main feedstocks for those bio-economy growths in Vietnam. To keep the sustainable development of the sugar industry, and to meet the demand of the food and non-food requirements, it is necessary to upgrade the sugar value chain through the adoption and the development of co-products of the sugar industry.

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Sugarcane Production, Diversification and Mechanization

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TS-I-01 (Lead)

Tech-innovations for resilient sugarcane production systems

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Uncertainties are becoming more frequent in sugarcane production systems and the industries that depend on them. These uncertainties often stem from fluctuations in sugarcane production levels—whether in excess or deficit—and variations in quality. Moreover, disruptions in sugarcane processing industries are influenced by fluctuating prices of processed products, state policies, international trade policies, and local industry-related issues. In response, cane growers and dependent industries must make necessary adjustments. The uncertainties in sugarcane production primarily arise from unexpected changes in production environments. Therefore, it is crucial to design and adopt resilient sugarcane production systems capable of mitigating adverse impacts on growers and related industries. This presentation focuses on critical innovations needed across several key areas to evolve resilient sugarcane production systems:

1. **Climate-smart technologies:** Given the reality of climate change, technologies that help adapt to climatic variations are essential. This includes developing sugarcane varieties tolerant to moisture stress and high temperatures, employing precision crop management techniques, and utilizing precise weather forecasting tools.

2. **Sustainable farming practices:** Innovations in sustainable practices such as conservation agriculture, agroforestry, organic inputs, and integrated practices are needed to maintain soil health, conserve water, and reduce reliance on external inputs.

3. **Digital agriculture:** Increasing the use of digital tools such as sensors, drones, Internet of Things (IoT), and blockchain for better crop, soil, and livestock monitoring can enable data-driven decision-making and improve resource management.

4. **Crop diversification:** Promoting diverse sugarcane varieties and cropping systems that include intercropping and rotations can enhance resilience against pests, diseases, and environmental stresses.

5. **Genetic improvement:** Investing in genetic improvement and breeding programs for varietal traits like higher yields and resilience to climate extremes under different agro-climatic conditions is essential.

6. **Water management:** Developing innovative irrigation techniques such as automated micro-irrigation, water-saving technologies, and efficient water storage systems is crucial to cope with changing rainfall patterns and water scarcity.

7. **Integrated pest and disease management:** Implementing integrated pest and disease management strategies that minimize chemical pesticide use and incorporate biological control methods and resistant sugarcane varieties is vital.

8. **Mid-course correction technologies:** Being prepared with contingency plans and technologies to quickly adapt to weather anomalies, pest outbreaks, transportation disruptions, and industry closures is necessary.

9. **Value chain innovation:** Innovations in transportation, storage, and market information systems can improve market access for smallholder farmers, ensure fair prices, and reduce post-harvest losses.

10. **Capacity building and knowledge sharing:** Enhancing education, training, and extension services to equip farmers with the skills and knowledge to adapt to changing conditions is critical. Investment in technology transfer programs is also essential.

11. **Policy support:** State policies that support sustainable agriculture, facilitate technology adoption, and incentivize investments in resilience-building measures are pivotal.

By focusing on these areas, sugarcane production systems can enhance their resilience to challenges, thereby providing greater security to farmers and industries dependent on sugarcane.

TS-I-02 (Lead)

Continuous emergence of new variants in sugarcane red rot pathogen *Colletotrichum falcatum*: who wins, the host or the fungus?

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Red rot caused by Colletotrichum falcatum is more than a century old disease in sugarcane, responsible for several epiphytotics in India and many other countries. Since the pathogen destroys cane stalks and inflicting huge damages to cane and sugar productivity, detailed studies were conducted on disease epidemics. Earlier the pathogenic variants were categorized into 'light' and 'dark' isolates and the former was considered as highly sporulating and virulent and the latter as less sporulating and less virulent. Since there was lack of clarity on pathogenic variation, a set of host differentials were identified to characterize pathogenic variation among C. falcatum isolates. Based on the distinct pathogenicity profile on the differentials, the isolates were designated into pathotypes. During the last 30 years, about 13 pathotypes were designated and they were used to screen sugarcane varieties for red rot resistance. Many elite hybrid varieties of sugarcane were short-lived under field conditions due to breakdown to the new C. falcatum variants hence they were removed from cultivation in different decades. Pathogenic variation among isolates has been assessed over the years, categorizing them into virulent, moderately virulent, and less virulent groups. It was observed that while isolates consistently exhibited virulence on susceptible varieties, they did not consistently affect resistant or moderately susceptible (MS) varieties. Interestingly, isolates from susceptible and MS varieties showed similar virulence patterns. However, resistant varieties sometimes succumbed to pathogenic virulence, indicating that the pathogen can overcome resistance barriers to cause disease. This phenomenon was evident in recent red rot epidemics on the cv Co 0238, exacerbated by monoculture practices in subtropical regions. Such conditions exert selection pressure, promoting rapid evolution and adaptation of virulent pathotypes that can break down resistance. Overall, the studies underscore that *C. falcatum* continuously evolves in the field, with newer isolates demonstrating greater virulence compared to older ones. The adaptation of the pathogen to host cultivars is a major driver in the evolution of new variants with enhanced virulence, leading to the breakdown of resistance in sugarcane varieties. This ongoing evolution highlights the challenges in managing red rot and emphasizes the need for continuous vigilance and innovative strategies in sugarcane cultivation and disease management.

TS-I-03 (Lead)

Enhancing productivity and economic security through sugarcane based cropping system

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Sugarcane is the second most important cash crop after cotton, playing a crucial role in elevating the economic condition of rural India. It contributes to making the region self-sufficient in sweeteners, providing multifaceted opportunities for entrepreneurs and generating employment. The diversified uses of every part of this crop make it an extremely valuable commodity worldwide and relentless efforts are being made to increase its productivity. Sugarcane is a significant industrial crop cultivated in 110 tropical and subtropical countries worldwide due to its high sugar concentration and, more recently, for the production of ethanol as a biofuel source. It is a long-duration and widely spaced crop, providing ample opportunity to grow short-duration, high-value intercrops. This allows harnessing the potential of the environment and utilizing natural resources to increase production and profit per unit area over time. Sugarcane-based cropping systems can act as a source of quality food in terms of the supply of diverse food like sweeteners, pulses, vegetables and oilseeds. Diversification provides many advantages to the farmers if planned strategically. The well-designed sequential and intercropping system also addresses issues of nutritional security and soil health. A field experiment was conducted during 2021-23 to evaluate eight cropping systems for their production potential and economic security. The soil was low in available N (220 kg/ ha), medium in available P (10.8 kg/ ha) and low in available K (109 kg/ ha) content. Data were recorded on yield, quality and economic feasibility of systems. The rice autumn sugarcane + garlic – green gram system gave the highest cane equivalent yield (241.0 t/ ha), net returns (Rs. 5, 46200/ ha) and benefit-cost ratio (2.09) as against other combinations that showed the superiority of these systems over rest of the cropping systems.

TS-I-04 (Lead)

The disease resistance of the sugarcane cultivars released in the past two decades in Florida.

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Sugarcane diseases are the main factor for the removal of cultivars from commercial production; therefore, developing high-yielding, disease-resistant cultivars is necessary for sustainable sugarcane production worldwide. Several diseases in Florida are economically important because of significant yield losses. Brown rust, caused by *Puccinia melanocephala*; orange rust, caused by *P. kuehnii*; leaf scald, caused by *Xanthomonas albilineans*; mosaic, caused by sugarcane mosaic virus; ratoon stunt (RSD), caused by *Leifsonia xyli* subsp. *xyli* and smut, caused by *Sporisorium scitamineum*, are the most economically significant diseases in Florida and the US sugarcane industry. The sugarcane breeding and development program at Canal Point (CP program), FL, has continued to select high-yielding and disease-resistant cultivars for the Florida sugarcane Industry since the 1960s. In this study, we evaluated cultivars released for commercial production in the past two decades to determine the success of our selection program for disease resistance. Sixty-nine cultivars were released from 2004 to 2023, 22 were released from 2004 to 2013, and 47 were released from 2014 to 2023.

The cultivars resistant to any disease were given a score of four. Moderately resistant cultivars received a score of three for each disease, moderately susceptible cultivars received a score of two, and susceptible cultivars received a score of one. The cumulative sums of these scores for all six diseases were used for the evaluation. A higher score represents a higher resistance. The results show that the cultivars released in the past decade had a higher score than the previous decade. However, CPCL 05-1201, released in 2012 for commercial production, is resistant or moderately resistant and has a score of 23 out of 24; it has been cultivated in about 30% of the acreage in Florida. Four cultivars released in the last decade have either equal or better resistance scores than CPCL 05-1201. The resistance to orange rust has significantly increased ($p<0.01$) in the last decade compared to the previous decade because screening for orange rust resistance started in 2008. The resistance to brown rust, leaf scald, smut, and RSD increased significantly ($p<0.05$), but mosaic resistance remained the same between the two decades. Of 69 released cultivars, 57 were tested for the brown rust resistance locus (*Bru*1), and 32 had the *Bru* 1 locus. Among cultivars without the *Bru*1 marker, two were resistant, 12 were moderately resistant, two were moderately susceptible, and nine were susceptible to brown rust. Thirteen of 22 released cultivars between 2004 and 2013 had the *Bru*1 marker. However, 17 cultivars out of 33 released between 2014 and 2020 had the *Bru*1 marker. Cultivars that were moderately resistant and moderately susceptible to brown rust were released because the use of fungicides to control brown rust started in 2013-2014. The data suggest that the CP program has increased disease resistance throughout the past two decades, particularly in the last decade.

TS-I-05

Foot-operated sett cutter for sugarcane farmers

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One of the important unit operations in sugarcane cultivation is sett cutting. The number of setts with 3 buds for normal planting per hectare ranges from 37,000 to 40,000, but some farmers use up to 75,000 setts with 2 buds at narrower row-row distances. An earlier study indicated that sett cutting constitutes about 15.8% of the total cost of sugarcane cultivation per hectare. ICAR-IISR Lucknow developed a hand-operated bud scooping device capable of handling 150 buds per hour. Their study also indicated a requirement of 90 man-hours per hectare for manual sett cutting operations using heavy manual knives or sickles. The labor requirement for sett cutting constitutes 2.51% of the total 3,588 man-hours per hectare for sugarcane cultivation. A study conducted in selected villages in the Erode district of Tamil Nadu state found that all farmers were using 500g hand-operated knives for in-situ sett cutting during sugarcane plantation. However, cuts made with these knives were often not smooth and proper. Ergonomic studies also indicated that heavy muscle power was required for continuous cutting with hand-operated knives, leading to minor injuries. Material composition analysis of the conventionally used hand knives showed very low carbon content (< 0.15%), necessitating frequent blade sharpening. Considering ergonomic principles and mechanical aspects, a foot-operated sett cutter was designed and developed for use by both male and female workers. This foot-operated sett cutter consists of a platform, cutter, and pedal assembly, weighing 28 kg. The cutter's capacity was tested in standing and sitting postures, achieving 830 and 673 setts per hour with male workers, and 700 and 620 setts per hour with female workers, respectively. The developed sett cutter demonstrated a 10.84% and 9.80% increase in the number of setts cut per hour by male and female workers compared to the traditional hand-operated method. The operating cost per 1,000 setts was found to be 8% lower with the developed foot-operated sett cutter. Moreover, the developed tool can also be successfully used for node cutting. It has the potential for adoption by marginal and small farmers in India and other developing countries.

TS-I-06

Geostatistical modelling for spatial variability assessment of soil fertility in sugarcane growing soils of Jalna District, Maharashtra, India

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Sugarcane (Saccharum officinarum L.) is one of the important cash crops grown in India. The sugarcane growing soils are under serious threats of declining soil fertility by many factors like intensive cultivation, indiscriminate use of chemical fertilizer without supplementing organic matter in the soil, excess use of irrigation water and poor drainage. The very existence of spatial variability in soil properties entails site-specific management for balanced plant nutrition towards achieving sustainable sugarcane production which is the epitome of precision agriculture. The information on spatial variability of soil properties of sugarcane growing areas in Maharashtra is lacking and hence adoption of site-specific nutrient management is not possible in each parcel of land of the operational area of the sugar mill. The site-specific management efforts are mostly based on management spatial variation so that individual land parcels receive the kinds and quantities of inputs. In this respect, the application of geostatistical techniques is becoming standard for assessing the variability of soil nutrients and input-based sugarcane production. Hence, the present investigation was conducted in the operational area of the Samarth SSK sugar mill of Ambad Taluka of Jalna District, Maharashtra, India to capture geospatial variability and in-depth analysis of the modelling parameters with the existing nutrient management. A total of 3500 surface soil samples (0-22 cm depth) from Ambad taluka were collected from sugarcane growing farmers fields and analyzed for pH, electrical conductivity, available nitrogen, phosphorus and potassium. The sampling points were marked in the digital shape file with survey number of Ambad taluka and prepared base map for kriging interpolation technique in Arc GIS software 10.1 version. The geodatabase was subjected to kriging through best fit experimental semivariogram based on the lowest root mean squared error. The exponential model was found to best fit pH, EC, Organic carbon, Available phosphorus and potassium whereas the spherical model was for available nitrogen. Spatial dependence was moderate for all soil fertility parameters (N:S ratio 25-75) whereas available nitrogen and phosphorus exhibited strong spatial dependency (N:S ratio <25%). The spatial distribution of maps showed that pH and EC having relatively longer rangesin modelling parameters are the indication of the intrinsic nature of these soil properties which do not change significantly due to human interventions. Electrical conductivity is found within the safe limit (<1 dSm^{-1}) indicating no hazard of salinity that does not affect the plant growth. This fact especially holds good in black soil regions

owing to its higher buffering capacities. Organic carbon and major nutrients showed large-scale variability over a short distance due to extrinsic variation in management practices. This kind of spatial variability assessment of soil fertility parameters through geostatistical modelling can support site-specific plant nutrient management in sugarcane crops and enhancing of sugarcane productivity. GIS techniques are effective in the interpolation of unsampled data which helps to manage soil fertility of larger sugarcane growing areas. This indeed is a time-efficient and cost-effective technology for generating soil analysis reports of the operational area of the sugar mill.

TS-I-07

Recent advances and perspectives of sugarcane mechanization in India

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Sugarcane is one of the major commercial crops, which provides livelihood to 50 million farmers and their families. Sugarcane production and productivity are increasing by cumulative annual growth rates of 1.64 and 1.44%, respectively during the last decade. The increasing demand is not only for sugar production but also for the production of ethanol, which is seen as a major component of the energy security of the country. Production of sugarcane crops is an energy and labour-intensive enterprise. The mechanisation effort has seen significant progress in recent years to overcome the demand for manual labour in various farm operations. Several tools and machinery have been developed in the recent past, which can improve labour productivity, and reduce the cost of operation and drudgery for farmer workers. This paper explores the recent advances in sugarcane mechanization in India, highlighting innovations in seedbed preparation, planting, interculture and harvesting technologies. Key developments include the adoption of mechanized planters, ratoon managers and harvesters, advancements in precision agriculture, and the integration of IoT and AI for better crop management. The potential socio-economic and environmental benefits of sugarcane mechanization include increased yield, reduced labor dependency, and improved resource use efficiency. The paper also provides future perspectives and recommendations for enhancing the mechanization of sugarcane cultivation in India, emphasizing the need for government support, farmer education, and the development of cost-effective, scalable solutions tailored to the country's diverse agricultural landscape.

TS-I-08

Efficient water management through micro irrigation systems in sugarcane

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In India, the sugarcane crop is grown in over 5 million ha area and plays a dominant role in the country's economy. It is proved that water is the most crucial input for sustained sugarcane production. Drip is an advanced method of irrigation with a high frequency of water application as per the need of the crop. In drip irrigation, water is not applied to bare soil areas between the plants, but concentrates its application at the root zone of the crop. It does not in any way reduce or curtail the water requirement of the crop but only the losses such as conveyance, seepage and irrigation to unwanted areas are avoided. Application of fertilizers through drip irrigation is also gaining momentum in the country, as these techniques have the advantage of the application of fertilizers at the appropriate rate and in the desired concentration. It also provides flexibility of fertilization which enables specific requirements of the crops to be met at different stages of its growth. The fertilizer losses are avoided and there is improvement in fertilizer use efficiency. The rain gun sprinkler is an advanced technology of sprinkler irrigation being accepted by the cultivators of sugarcane crops. It has the advantage of covering more area at a time by replacing many small sprinklers with one rain gun. The rain guns give gentle rain, which matches the infiltration rate of soil and hence there is no erosion or stagnant water. The rain gun sprinkler has the advantage of achieving higher water and fertilizer use efficiencies compared to surface irrigation. An inverted sprinkler system is a new irrigation system with discharge of 400 litres per hour and a diameter of coverage of 10 to 14 m. The system can be operated at a low pressure of 1 to 1.5 kg per square cm and the system shower the water over the crop.

TS-I-09

Asian Subterranean Termite (*Coptotermus gestroi* (Wasmann)) infestation in Sugarcane in Fiji: Current status

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The invasive alien pest (*Coptotermus gestroi* (Wasmann)) has been considered to be an emerging sugarcane pest in Fiji for more than a decade. Movement of cane from the Drasa, Lovu, and Lautoka sectors without inspection by the Biosecurity Authority of Fiji, is prohibited due to possible termite infestation. A series of assessments were carried out to ascertain the current status of *C. gestroi* in sugarcane in Fiji. During the pest surveys in 2024, 628 farms in 38 sectors of the Sigatoka, Nadi, Lautoka, Ba, Tavua, Rakiraki, Labasa, and Seaqaqa districts of Lautoka, Rarawai, and Labasa sugars mills of Fiji were assessed for termite infestation. One farm in Drasa showed 0.18% termite incidence with 0.04% intensity. In a subsequent evaluation, termite baiting carried out randomly on 96 farms across different sectors did not lead to the trapping of termites. Further, during 2023-2024, 67 farms in the Lovu, Drasa, and Lautoka sectors of the Lautoka mill district, with a history of termite infestation, underwent repeated assessments through baiting and physical examination for field infestation of *C. gastroi*. All the farms in this evaluation had the sugarcane variety Mana cultivated in differential topography, such as rolling fields, sloppy lands, and plain lands, mostly with forest trees in the surroundings. Low levels of termite activity and cane infestation were documented. In Lovu, of the 44 farms baited for termites with 88 traps, *C. gestroi* was found in 6.82% of traps. The cane infestation was observed in three of the farms assessed. Overall incidence and intensity of termite infestation in the Lovu sector were 0.14% and 0.03% respectively rendering *C. gestroi* infestation on sugarcane to be occasional, sporadic, and insignificant. In Drasa, of the 8 farms inspected, 3 traps out of 16 traps laid (18.75%) had shown termite attraction with none of the farms showing termite infestation in the cane. In Lautoka, of the 12 farms assessed, one trap out of 24 traps (4.17%) showed termites being trapped in one farm. However, no termite infestation of cane was observed during the assessment. Due to lease expiry, three farms in Lautoka were bereft of cane cultivation and thus excluded from assessment. Instances of termite infestations in other crops or trees on the assessed farms, as well as in the surrounding area, and frequent infestations in houses during these assessments, indicated that sugarcane is not a preferred host and that *C. gestroi* has the propensity to be a structural pest.

TS-I-10

Fiji leaf gall disease: A relook on prevalence and impact on sugarcane production in Fiji

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Fiji Leaf Gall (FLG) disease was first observed in Fiji in the 1800s and by 1908, it threatened the existence of the sugar Industry in Fiji. Since it is caused by an obligate pathogen, reovirus, and is inherited through vegetative propagation, the field management of FLG in the multi-year ratooning system of Fiji involves rogueing of diseased clumps. This has been the primary management tool for over a century, necessitating a significant investment of manpower. Screening for FLG resistance is another strategy adopted in Fiji. However, the actual status of the disease is unclear, as we do not have specific data on the percent incidence or intensity or its impact on sugarcane productivity in Fiji thus making it difficult to justify the expenditure on roguing and screening. Hence, extensive field assessments were conducted from January 2023 to March 2024 in 2095 farms in Vitu Levu of 4567.9 ha and 126 farms in Vanua Levu of 264.6 ha, covering the 38 sectors in the Lautoka, Rarawai, and Labasa mill districts. FLG has not been detected in the cane fields of Vanua Levu, the second major island of Fiji, for at least three decades. Therefore, the small-scale assessment was made to confirm the island's complete freedom from the disease. Clumps infected with FLG were identified by the galls on the adaxial surface of the leaves in the young crops and by the stunting with typical leaf distortion in mature crops. The sample size was a minimum of 300 clumps per field. In Viti Levu island, of the surveyed farms, the maximum number of farms (1933) had the susceptible variety Mana with 91.4%% area while the other varieties (Kaba, Naidiri, Aiwa, Kiuva, LF91-1925, Qamea, Ragnar, Viwa, and Waya), including varietal mixtures in the surveyed area, were from 162 farms constituting 8.6% area. In Vanua Levu island, all the surveyed farms had varieties other than Mana. Surveys confirmed that Vanua Levu island remains free of FLG. In Viti Levu, all the infected clumps were observed in Mana, even though Kaba and Ragnar had a prior history of FLG. During 2023-24, no incidence of FLG was observed in the 32 farms of Mana mixed with other varieties as well as in four fields of mixtures without Mana. The impact of the presence of Duruka (*Saccharum edule* Hasskarl.) which is grown as an alternate source of income in sugarcane farms on FLG was insignificant (0.049), significant with Duruka FLG (0.582) and insignificantly correlated (0.042) to the hopper vector(*Perkinsiella* spp.).

In the mill-wise analysis, of the three mills, the Labasa Mill area remained free of FLG. The Lautoka Mill area was the most affected with 1.4% of surveyed farms and 1.1% of the area with FLG incidence. The Rarawai mill area had 0.5% of the surveyed farms and 0.2% of the surveyed area affected by FLG. In the Lautoka mill area, of the three districts, Sigatoka had a slightly higher number of farms with FLG incidence (2.2%) than Nadi (2%) but, the area infected was higher in the latter (1.7%) than the former(1.5%) and Lautoka enjoyed absolute freedom from the

disease. In the Rarawai mill area, the farms affected (0.5%) and the affected area(0.2%) were lower compared to the surveyed area under the Lautoka mill. Among the three districts under Rarawai, the sector Tavua had no incidence in the 332 farms and 1237ha area surveyed while Ba had FLG in 0.9% of farms and 0.3% of the area surveyed while Rakiraki had FLG in one farm of the 165 farms surveyed (0.7%) in one ha of the total 456.6ha surveyed area (0.3%). It was observed that the Meigunyah and Yako sectors of Nadi district, Olosara of Sigatoka, Varoko, and Mota of Ba, Ellington 1, Malau, and Nanuku of Penanag were free from the disease. The Maolo sector (Nadi) was the most affected with 4.04% of the farms and 3.27% area infected, while Cuvu (Sigatoka) followed closely with 3.76% of farms infected and 2.98% of the area affected.

Overall, in Viti Levu, 1.72% of the total farms and 1.11% of the area were found to be infected with FLG. A total of 580507 clumps were inspected and 0.04% of the clumps were found with FLG. The crop yield was not impacted by the extremely low level of infected clumps. It was observed that the Mana variety which was the most susceptible among the varieties surveyed had been cultivated in over 90% area of Viti Levu as multi-year ratoons. In several instances the infected crop could form millable canes, thus proving the increasing resilience of the crop and dilution of virulence of the pathogen. These facts demonstrate the need to reconsider the priority given to roguing and screening for FLG in Fiji.

TS-I-11

Influence of in situ sugarcane trash burning on physico-chemical properties of soil

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The present investigation was undertaken to characterize sugarcane trash and its ash generated after *in situ* trash burning and changes in soil properties as influenced by *in situ* trash burning. The sugarcane trash and its ash samples were collected from 15 selected sites of recently harvested sugarcane plots (var. CoM 0265) at village Padegaon, Dist. Satara, Maharashtra, India. The samples quantified and analyzed for nutrient composition. Similarly pre and post burning of sugarcane trash soil samples were also collected and analyzed in laboratory for soil physico-chemical and biological properties.

The percentage of ash received from sugarcane trash after burning was ranged from 7.30 to 10.8 per cent. The sugarcane trash composed of mean value of total carbon 41.66 per cent, total N – 0.51 per cent, total P – 0.34 per cent, total K – 0.85 per cent and total S - 0.16 per cent, while the total micronutrient contents were Fe - 8.68 mg kg^{-1}, Mn – 1.47 mg kg^{-1}, Zn – 1.32 mg kg^{-1} and Cu – 32 mg kg^{-1}. However, the sugarcane trash ash resulted in complete loss of TOC and total N, while total P up to 71 per cent, total K up to 79 per cent, total S up to 80 per cent, total Fe up to 21 per cent, Zn up to 93 per cent, Mn up to 41 per cent and Cu up to 11 per cent was observed.

The soil temperature at surface and at 5 cm depth were significantly increased almost 2.5 times (59.78 ^{o}C) and by 2.4 times (42.92 ^{o}C) while, the soil moisture at 5 cm soil depth significantly reduced from 26.89 per cent to 19.95 per cent due to *in situ* trash burning. There was no significant effect of *in situ* sugarcane trash burning on soil physical properties *viz.,* soil bulk density and soil porosity at 0 to 10 cm soil depth. The soil chemical properties as influenced by *in situ* sugarcane trash burning showed non-significant effect on soil pH, EC, TOC, $CaCO_3$, available P, available K and available micronutrients however, the available nitrogen was reduced significantly due to *in situ* sugarcane trash burning. The practice of sugarcane trash burning in Maharashtra state causes monitory loss of nutrients estimated about Rs. 990.67cr. yr^{-1}.

TS-I-12

Effect of long term integrated nutrient management on growth, cane yield and quality of preseasonal ratoon sugarcane in vertisol

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A long term field experiment was conducted at Central Sugarcane Research Station, Padegaon, Dist. Satara on pre-seasonal sugarcane (cv.Co-86032) in two cycles as plant cane followed by succeeding four ratoons in the first cycle to study the soil quality, carbon sequestration, cane yield, nutrient uptake and juice quality as influenced by long term use of INM to pre-seasonal sugarcane in Vertisol after completion of second cycle. The experiment was replicated thrice in RBD consisted of eight treatments *viz.* 100 % of RD through organics (T1), 100 % NPK through inorganic (T2), Fertilizer dose (AST) with FYM and biofertilizers(T3), 75 % of RD through organics + 25 % RD through inorganics(T4), 50 % of RD through organics and 50 % of RD through inorganics(T5), 25% of RD through organics + 75 % RD through inorganics (T6). Use of Rishi- Krishi Tantra (T7) and Use of Jivamrut (T8) with three replications on plots of 10.0 m x 7.2 m with RDF 400 : 170 : 170 to plant cane and 250 : 115 : 115 to ratoon. AST 400 : 170 : 128 to plant and 300 : 140 : 105 kg ha^{-1} N,P_2O_5 and K_2O to ratoon cane, organic sources *viz.* green manuring, FYM, PMC, vermicompost and biofertilizers *viz.* composting culture, azotobactor, acetobactor and PSB were applied as per treatments to plant cane and ratoon. The number of millable cane were significantly influenced by different integrated nutrient management treatments. The T_6 i.e. 25 % RD through organics and 75% RD through inorganic treatment significantly recorded higher number of millable canes, cane, top and CCS. The application of 25 % RD through organics and 75 % RD through inorganic treatment recorded maximum sucrose content while brix, pol and purity of pre-seasonal ratoon sugarcane were non significantly influenced due to various integrated nutrient management treatments except brix at 1st ratoon. The application of 100% NPK through inorganic fertilizers (T_2) recorded higher values for reducing sugars in sugarcane.

TS-I-13

Novel nuancesin exploiting endophytic entomopathogenic fungi: An agro-ecosystems friendly approach for sugarcane pest management

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Sugarcane (*Saccharum officinarum* L.) is recognized as an important agro-industrial, semi-perennial, sugar-producing semi-perennial monocot crop cultivated in more than 120 tropical and subtropical countries with an annual production of about 1.89 billion tons. India is second major sugarcane producing country in the world, with the annual average planting area of 5.8 million ha, producing cane yields of 9.0 million tons.Long-term monoculture and excessive use inorganicagro-inputs have led to soil degradation and water pollutionin the sugarcane areas have become key ecological impediments for upsurge of pest organisms.More than 1200 species of insect pests and 80 diseases occur on sugarcane worldwide at different growth stages, with their pest status dependent on the agro-climatic zones. In India,nearly 60 insect species and 70 diseases have been accounted for attacking sugarcane cropfrom planting to harvest. Modern crop husbandry and climate change is a key factor for outbreaks of pests and diseases. The major yield reducing pests of sugarcane crop comprise complex of defoliators (fall armyworm), sap sucking insects (crown mealybugs, aphids, thrips), stalk feeders (early shoot borer, internode borer, top borer), and root feeders (white grubs, root borers, termites); spider mites and rodents; diseases such as red-rot, smut, pokkah boeng are major yield reducing factors.Use of chemical pesticides play crucial roles in the management of pest complex, yet their hazards due to degradation of soil and environmentintegrities urge the scientific community to propose biological control as alternative pest management strategies. Fungal biocontrol agents such as *Beauveria bassiana* and *Metarhizium anisopliae* (Hypocreales Ascomycota) constitute a naturally occurring reservoir of entomopathogenic fungi in soils and crop tissues of conventionally grown sugarcane.Several studies have reported enhanced plant growth, stress resistance and increased crop yield following inoculation of *B. bassiana* and *M. anisopliae* as endophytes via seed immersion, foliar spray, stem injection, soil drench methods.The aim of this paper is intended to analyze several studies to highlight theenduses of endophytic entomopathogenic fungi in sugarcane production by addressingsome novel production and application nuances including:(1) the fungal strain selection and characterization, (2) progress on development of improved bio-formulation, (3) impact of field inoculation or delivery methods of endophytes, (4)the mechanism of host induced resistance rendered by introduced endophytes, and (5) the future proposed research directions on use of endophytes as a component in the integrated pest management (IPM) system. Future studies should focus on maximizing the utilization of endophytic entomopathogenic fungi for sustainable pest management during sugarcane production in India.

TS-I-14

The influence of fertigation on yield and ratooning ability of sugarcane

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This research aimed to compare the effects of drip irrigation and fertilizer application on growth, root length density (RLD), yield, and yield components of sugarcane and to evaluate their impacts on ratooning ability. To achieve this objective, sugarcane cultivation practices were conducted in sandy clay loam soil over two years. In the plant crop, the effects of drip irrigation, drip fertigation, and rainfed conditions, on growth, yield, irrigation water use efficiency (IWUE), and fertilizer nutrient use efficiency (FNUE) were compared. The results showed that the drip fertigation treatment could produce the highest growth and yield. In the first ratoon crop (FRC), the effect of plant crop practices on the adaptation of FRC was evaluated by splitting the treatments of plant crops into two different practices: rainfed condition and drip fertigation. Growth, yield, and RLD were evaluated as indicators of the ratooning ability of the ratoon crop. The results showed that the previous crop practices did not affect the ratoon crop performance. For the FRC practice, drip fertigation exhibited the highest growth, yield, and ratooning ability. However, the RLD in both years of rainfed treatments was higher than in the drip irrigation treatments.

TS-I-15

Mechanized priming of planting material for sustainable sugarcane agriculture

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As for as Sugarcane is concerned, invariably, the planting material serves the primary source for the spread of all kinds of diseases in sugarcane. This clearly indicates the significance and need for using disease-free seed material for cultivating a healthy crop with more productivity. Apart from the conventional use of two or three budded setts as seed cane for planting in sugarcane agriculture, use of single bud setts/ settlings is gaining popularity, which results in uniform crop stand and reduces the required seed rate considerably by 1/10th. Priming of single / two/ three bud setts with various inputs ensures clean and disease free seeds for sustaining yield, sugar recovery and vigour of the sugarcane crop. In this context, the patented technology "Rapid treatment for planting materials of sugarcane and other vegetatively propagated crops (Indian Application No: 3323/CHE/2011)" granted in March'2024, will be highly helpful in raising healthy nursery and biotic/ abiotic stress management in the main field. Under field conditions, the farmers may not go for sett treatment. Even if they go for treatment, they prefer only short period of treatment within 1 hr. But it is not sufficient for effective treatment as our findings revealed that, the sett treatment requires prolonged duration of soaking and it is impractical to treat with many inputs at a time. Furthermore it is practically cumbersome process considering the volumness planting material, requirement of bigger container and higher quantity of chemical. Since single bud setts have less reservoir of food, addition of various inputs viz., fungicide, insecticide and nutrients are needed for producing healthy settlings with protection from biotic (pest and diseases) and abiotic stress (nutrient deficiency, drought and salinity). Addition of hot water treatment helps to eradicate pest and disease propagules and helps in varietal rejuvenation and increasing the productivity. Hence, the validated technology on mechanized sett treatment with various agro-inputs viz., hot water, chemicals and microbes in the 'Sugarcane Sett Treatment Device' (STD), developed by ICAR-SBI in collaboration with ICAR-CIAE will be highly useful to improve the crop protection and increase the productivity in sugarcane. This invention relates to a novel mechanized method for effective impregnation of any agrochemicals and/or microorganisms and other inputs into sugarcane planting materials *viz*., single/ two/ three budded setts and bud chips for protection from diseases/ pests and improvement of plant growth. This method of mechanized treatment uses vacuum, temperature and agitation at different levels individually or in combination and overcomes the practical cumbersome of conventional method of sett soaking with several advantages.

TS-I-16

Economizing water use in sugarcane cultivation in tropical India

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Field experiment was conducted during March, 2023-24, at ICAR-Sugarcane Breeding Institute, Coimbatore, India with the objectives of 1.To work out the best water saving ago-techniques in sugarcane cultivation in subtropical and tropical India. 2. To work out the irrigation requirement of the most prominent crops/ cropping system with sugarcane. 3. To work out the annual irrigation water use in sugarcane cropping at various irrigation methods. The experiment has been designed in RBD design with 7 methods of irrigation as treatments. Planting was taken up with double bud setts. 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, 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) 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). Similarly, the CCS% and CCS yield were also high in drip irrigation system (13.67 and 22.59 t/ ha). The irrigation water applied was significantly less (415.8 mm/ha) in drip irrigation system followed by trash mulching (785.4 mm/ha) and skip furrow (786.0 mm/ha) respectively when compared to farmers practice (913.8 mm/ha) and Prominent cropping system (1358.0 mm/ha). The water use efficiency was higher with drip irrigation system (39.75 kg/ha-cm), whereas the prominent cropping system has recorded 10.19 kg/ha-cm. Juice qualities such as juice Brix, Sucrose %, Purity % and CCS % at harvest were not influenced significantly due to irrigation methods.

TS-I-17

Co-occurrence of crown mealy bug, *Phenacoccus saccharifolii* (Green) and Pokkah boeng disease, *Fusarium verticillioides* (Sacc.) Nirenbergon sugarcane in cauvery delta zone of Tamil Nadu, India

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Sugarcane (*Saccharum officinarum* L.), a semi-perennial tropical and sub-tropical crop of 12-14 months duration is subjected to climatic vagaries across growing seasons. Although India is second largest producer of sugarcane, productivity of the crop is low. Climate change events increases pest associated risks by altering the interactions between herbivory insect, phyto-pathogen and crop host, and facilitating concomitant outbreaks of pest and pathogen leading to heavy yield loss. In this study, we report the co-occurrence of crown mealy bug, *Phenacoccus saccharifolii* (Green) and pokkah boeng disease, *Fusarium verticillioides* (Sacc.) Nirenberg on sugarcane growing areas in Tamil Nadu, India, though prior occurrence of these pests in different sugarcane growing regions is on the records. Two independent field surveys were carried out in Ariyalur and Perambalur districts in Tamil Nadu to assess the extent and causes of pest outbreaks. The first field survey was conducted during August-September 2022 in the sugarcane belt under the aegis of M/s Kothari Sugars and Chemicals Limited, Sathamangalam in Ariyalur district. The second survey was conducted during March-April 2023 in the sugarcane areas of Perambalur district. Field observations revealed that the ratoon crop was affected more than the plant crop in the same locality. This mealybug species was found in large colonies between the -2 and +1 crown leaf of the sugarcane plant. Infestation leads to severe mottling in the leaf whorl and death of the central shoot; while pokkah boeng symptom appear with a pronounced wrinkling, twisting, malformation and distortion of the crown leaves accompanied the distortion and shortening of the terminal nodes. Extent of crop damage was assessed based on the number of clumps affected among 100 clumps sampled as 10 clumps each at 10 different spots in per cent incidence. In most survey locations, combined attack of mealybug and pokkah boeng disease compounding the damage severity in 17 out of 24 (70.80%) fields surveyed. In the remaining fields, only pokkah boeng disease was observed. Colonization of the mealybug in the spindle aggravated disease severity. The extent of crop damage

ranged from nil to 66.66% in different fields. The cane varieties Co 06022 (ratoons), CoV 09356 (ratoons) and Co 86032 (ratoons) showed alarming levels of combined mealybug and pokkah boeng incidence. The mealy bug *P. saccharifolii* multiplication was profuse during intermittent summer rainfall as well as the monsoon period; while extended dry periods with rainless weather hastened mealybug infestation. Sudden downpour and incessant rains seems to main mortality factor to decimate the mealybug population pest attack. Enzootic activity of an encyrtid parasitoid *viz.Aenasius phenococci* (Ashmead) was noticed in a few areas surveyed.

TS-I-18 (Short)

Identification and evaluation of smut resistance in 20 GT sugarcane varieties

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Sugarcane smut, caused by *Sporisorium scitamineum* (Ustilaginomycetes), is the most important disease affecting sugarcane production in China. Currently, the main cultivated varieties Guitang (GT) 42 and Guiliu 05136 are commonly infected with smut. Ratoon cane is more severely affected by smut than planting cane, with field incidence ranging from 10% to 50%. In severe cases, sugarcane yield losses can exceed 50%. The use of resistant sugarcane varieties is the most economical and effective measure for controlling this disease. Different sugarcane varieties exhibit varying levels of resistance to smut, underscoring the importance of assessing disease resistance in breeding efforts. In this study, to assess smut resistance levels among sugarcane varieties, a total of 20 varieties from GXAAS underwent artificial inoculation for resistance evaluation, alongside natural resistance assessment. Smut-susceptible varieties ROC22, NCo310, NCo376, and F134 were used as controls. Combining smut incidence in both planting and ratoon cane, the results showed that incidence among the 20 sugarcane varieties ranged from 0.00% to 44.98%. The assessment categorized varieties as follows: 1 highly resistant (HR) variety, GT13-110; 7 resistant (R) varieties—GT08-56, GT08-158, GT09-1517, GT09-197, GT12-917, GT12-2476, and GT13-24; 3 moderately resistant (MR) varieties—GT08-272, GT12-162, and GT12-762; 4 moderately susceptible (MS) varieties—GT08-13, GT09-762, GT12-765, and GT13-18; 3 susceptible (S) varieties—GT09-3990, GT12-2262, and GT12-2004; and 2 highly susceptible (HS) varieties—GT09-324 and GT12-2425. Comparing results of artificial inoculation and natural infection in the same varieties, except for GT08-158, artificially inoculated plants showed higher smut incidence than those naturally infected across 19 varieties.

TS-I-19 (Short)

Chilo tumidicostalis Hampson: A destructive internal borer pest of sugarcane in Bihar

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The Plassey borer, *Chilo tumidicostalis* Hampson (Lepidoptera: Crambidae), is a stem-boring pest of sugarcane that was once considered minor but has now become a major pest in the regions where it is prevalent. The pest is primarily found in Uttar Pradesh, Bihar, West Bengal, Assam, and other northeastern states of India, as well as in countries such as Nepal, Bangladesh, Vietnam, Thailand, Burma, and Australia. There are two major concerns regarding this pest: the extent of damage it causes and the prolonged duration of infestation. The pest exhibits two forms of infestation: primary and secondary. Both external and internal damage symptoms were observed on affected cane, primarily on the upper portions of the top internodes. The incidence of the borer varied from 9.3% to 22.1% during 2021-22 and 8.6% to 19.3% during 2022-23, respectively. Percentage losses in weight per single cane, as well as in Brix %, Pol %, and Purity %, were compared between healthy and infested canes during 2021-22. The results showed reductions in weight per single cane by 20.0%, Brix by 15.68%, Pol by 17.82%, and Purity by 2.48%. During 2022-23, reductions in these parameters were observed to be 9.52%, 9.52%, 9.73%, and 0.79%, respectively. Infestation typically begins after node formation, with initial pest sightings recorded in May-June, persisting until December. Larval numbers ranged from 5 to 48 in plant crops and 3 to 30 in ratoon crops, primarily infesting the top 2-3 internodes of a single cane. Larvae typically prefer the softer upper portions of the cane. Incidence of the pest was higher in ratoon crops compared to plant crops due to a higher initial pest load in ratoons. The Plassey borer moth prefers new crops for egg-laying. Larval populations (gregarious phase) were higher on plant cane, as they prefer soft, immature top internodes for feeding and development. The larval duration in the gregarious phase was longer compared to the solitary phase. Advanced instar larvae share the same feeding tunnel and pupate within it. Frequently, 5-9 holes made by larvae are observed in a single internode, from which a brass-red colored ooze emerges. Due to active feeding, water and nutrient transport to the crown portion of the cane are significantly impaired, causing the entire crown to turn yellow and eventually dry up. Such affected crowns often topple with slight jerk.

TS-I-20 (Short)

Field assessment of pink mealybug *Saccharicoccus sacchari* (Cockerell) populations on different sugarcane varieties in Fiji

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Among the mealybugs on sugarcane in Fiji, the pink mealybug, *Saccharicoccus sacchari* is the most common. The pest is observed on the cane throughout the year on the underground stools as well as on the internodes. The attack is consistent during pre-monsoon and post-monsoon periods. The population levels of *S. sacchari* were assessed in 2024 on nine sugarcane varieties including a ready-to-be-released variety (LF-11-0233) and an unapproved variety (Whitehorse) in Viti Levu, one of the two major islands in the archipelago of Fiji, and nine varieties including three unapproved varieties (Hawaii, LF 3 and Mehnudin) in Vanua Levu, the northern island. Mealybug infestation and damaged canes were assessed as percent intensity (mean number of adult mealybugs per cane) and percent incidence (percentage of damaged canes). Significant variations in the intensity (1.07- 4.35/cane) and percent incidences (8.1-48.87%) of *S. sacchari* were observed among different varieties in both Viti Levu and Vanua Levu. The lowest intensity of pink mealybug in Viti Levu was observed on Kiuva (1.16) and the highest numbers per cane were on Mana (3.54), Naidiri (4.12), and an unapproved popular variety Whitehorse (4.35). The percent incidence was found to be the lowest on Ragnar with 11.27% of canes infested with *S. sacchari* while the highest percent incidence of 38.56% was on the variety Whitehorse. Among the registered varieties, Naidiri (31.53%), Mana (27.46), and Kiuva (25.17)showed the highest percent incidence of *S.sacchari*. In Vanua Levu, the number of adult mealybugs per cane was the lowest in an unapproved but widely prevalent variety, Hawaii (1.11) as well as an approved variety, Kiuva (1.07). A popular unapproved variety LF3 hosted the highest number of mature mealybugs (3.88) per cane. Among the approved varieties, Mali (2.64) and LF 91-1925(3.02) had the greatest number of mealybugs/cane and were not significantly different from each other. The varieties Kiuva (8.1) and Viwa (11.66) were the least susceptible to *S. sacchari* with the lowest percent damaged canes in Vanua Levu while the popular unapproved variety LF3 was highly susceptible to the mealybug with the highest percent of damaged canes (48.87). Among the approved varieties, LF1925 and Mali had the highest percentage of infested canes (38.83 and 40.38 respectively). The significant consequences of such variations among the responses of different varieties to *S. sacchari* in a tropical island nation that practices minimal crop protection and relies on rainfed cane cultivation leaving the crop vulnerable to prolonged periods of moisture stress are discussed.

TS-I-21 (Short)

Putative vectors of sugarcane grassy shoot and sugarcane white leaf-associated phytoplasma in eastern Uttar Pradesh, India

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Phytoplasmas have been reported to be associated with two major sugarcane diseases, viz. sugarcane grassy shoot (SCGS) and sugarcane white leaf (SCWL) causing significant economic losses to sugarcane yield and sugar recovery in the Asian countries. During a survey of sugarcane fields at the Sugarcane Research Institute, Shahjahanpur, Uttar Pradesh, India from July to September 2021, a disease incidence ranging from ~3% to 15% of SCGS and SCWL respectively were observed in different fields of sugarcane varieties CoS 13231, CoLk 94184, CoSe 13452 and CoS 08272. Direct and nested PCR amplification of 16S rRNA gene using the universal phytoplasma primers (P1/P7 and R16F2n/R16R2) from the symptomatic plants was performed to confirm the presence of phytoplasma association. Sequencing of the same revealed the association of a *Candidatus* Phytoplasma sacchari strain (16Sr XI-B subgroup) with the SCGS and SCWL affected plants. The fields were also examined for the association of insect vectors with the help of sweep-net and sticky traps. Two leafhopper species, viz. *Exitianus indicus* (Distant) and *Pyrilla purpusilla* were identified as the prevalent feeding species of the Auchenorrhyncha fauna in the symptomatic sugarcane fields. Both the leafhopper species were tested positive for the presence of *Ca*. P. sacchari strain by employing same sets of primer pairs and sequence analysis. Phylogenetic analysis also suggested that the phytoplasma strains from symptomatic sugarcane plants and leafhoppers in the present study were members of 16SrXI-B subgroup. The confirmation of association of SCGS and SCWL phytoplasma strains in *E. indicus* and *P. purpusilla* population is crucial to understand the secondary spread of this phytoplasma in sugarcane plants for effective management of the disease.

TS-I-22 (Short)

A case study of sub-surface drainage (SSD) project on saline soil reclamation and its effect on sugarcane production and productivity implemented by Shree Datta Shetakari Sahakari Sakhar Karkhana Ltd. Shirol (Kolhapur) Maharashtra

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Sugarcane (*Saccharum* sp. hybrid) crop holds a vital role in global agriculture, sugarcane is a basis for the sugar, bioenergy, sugarcane a perennial grass with both economic & medical benefits. Besides sugar production, crop serves as a most important biological resource for ethanal, bagas , molasses rum & cachaca India is second largest sugar producing country after Brazil. In India sugarcane in cultivated in two major climate zone.Sub tropical and tropical zone.Uttar Pradesh, Bihar, Punjab & Haryana states come under sub tropical zone while tropical zone comprises Maharashtra, Gujrat, Tamilnadu, Andhra pradesh and Karnataka. In India sugarcane industry influences rural life of sugarcane growers & by providing direct & indirect employment. In Maharashtra, area under sugarcane is about 10 lakhs hector & since last five to six decades farmers are growing sugarcane crop special in Western Maharashtra districts such as Kolhapur, Sangli, Satara. But the prolonged & intensive cane cultivation, use of ample water, chemical fertilizers and distrucation in natural drains, etc. majority of soils under sugarcane cultivation are suffering from drain problem i.e. waterlogging & soil salinity. And to reclaim such problematic Soils artificial sub-surface drainage technology is the only proven & accepted technique.

In assessment study an experiment was conducted in 2018 randomly selected farmers field in village Shedshal. Where Sub-surface drainage project was implemented during 2016 on 440 hector area out of which 220 hector area is under cultivation from 2016. In order to study the impact of Sub-surface drains on soil properties soil samples were collected from randomly selected farmers field, and analysed for various salinity parameters viz. pH, Ec, Soc and also the drain water sample were collected periodically and analysed for pH, Ec, Ca^{++}, Mg^{++}, Na^{+}, it has been observed that 15 m drain spacing & 120 cm, drain depth was found better in improving the soil properties.

TS-I-23 (Short)

Status and incidence of Fall Armyworm *Spodoptera frugiperda* (J.E. Smith) on corn in Tamil Nadu, India

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The Fall Armyworm (FAW), *Spodoptera frugiperda* J. E. Smith (Lepidoptera: Noctuidae) is a migratory insect pest known for its broad diet, feeding on over 350 plant species, particularly favoring cereal crops worldwide.In 2016, the fall armyworm, a new invasive pest that had been prevalent in the Americas for several decades, was reported for the first time in Africa. By 2018, it had spread to India and rapidly expanded across the continent and beyond. A field study was carried out to document the prevalence and impact of fall armyworm (*Spodoptera frugiperda*) in corn across eight districts of Tamil Nadu during the 2023-2024, *Kharif* seasons. The survey covered three blocks within each of the eight districts selected for the study. The extent of damage inflicted by Fall Armyworm larvae varied significantly, ranging from mild leaf feeding to severe defoliation and ear damage in heavily infested fields. The extent of fall armyworm damage was recorded from 6.22% to 63.05% in different locations. The highest pest incidence was observed in Veppur block of Perambalur district in Tamil Nadu, reaching 63.05%. The lowest pest incidence was recorded in Koradacheraiblock of Thiruvallur in Tamil Nadu has 6.22%. Perambalur district had the highest mean per cent incidence across all district 36.42%, while Tiruchirappalli district had the lowest mean per cent 11.96%.The higher incidence rates in certainlocations underscore the urgency for targeted pest management strategies aimed at reducing crop losses and improving overall productivity. By integrating field observations, statistical analyses, and farmer perspectives, the research enhances our understanding of pest dynamics and informs targeted interventions aimed at improving crop resilience and livelihood sustainability in the face of emerging agricultural challenges. To address the incidence of Fall Armyworm (*Spodoptera frugiperda*) on corn in Tamil Nadu effectively, a multifaceted Integrated Pest Management (IPM) strategy is crucial. Firstly, establishing a robust monitoring and early detection system is essential, utilizing pheromone traps and field scouting to identify outbreaks before they escalate. Additionally, implementing cultural controls, such as crop rotation and adjusting sowing dates, can help disrupt the pest's life cycle and reduce its impact.

TS-I-24 (Short)

Population dynamics of sorghum insect pests in Cauvery delta districts of Tamil Nadu in India

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Sorghum (*Sorghum bicolor* (L.) Moench) recognized for its dual-purpose as a food and biofuel crop. It is a versatile and resilient crop known for its adaptability to various agro-climatic conditions. It is primarily cultivated for its stalks which are rich in fermentable sugars making it a valuable crop for biofuel production.Sorghum is also useful as a source of food, fodder and forage contributing to its economic importance in many regions and presents significant potential for enhancing agricultural productivity and rural livelihoods in Tamil Nadu. This survey investigates the pest incidence of sweet sorghum across the Cauvery Delta districts of Tamil Nadu includes Tiruchirappalli, Thanjavur, Thiruvarur, Cuddalore, Mayiladuthurai, Nagapattinam,Ariyalur and Perambalur areas. The primary objective was to identify the prevalent pests affecting sweet sorghum and assess their population dynamics and impact on crop yield.Field surveys were carried out during the 2023-2024 cropping season and pest incidence data were collected from multiple randomly selected farms within each district. Collected insect specimens were identified to species level and predominant species were identified. The survey revealed the occurrence of three key pests including the aphids (*Rhopalosiphum maidis*), stem borer (*Chilo partellus*), and armyworms (*Spodoptera frugiperda*)with varying intensity.Tiruchirappalli, Thanjavur and Thiruvarur districts reported high infestation rates of stem borer averaging 13.8%, 12% and 10% leading to substantial yield losses.Cuddalore, Nagapattinam and Mayiladudurai districts experienced occurrence of aphid with infestation levels reaching up to 21.7% in some areas primarily affecting plant vigour and productivity. The result of this study provides important information related to the dynamics and status of insects in sorghum fields. The survey highlights the critical need for implementing integrated pest management (IPM) strategies tailored to the specific pest pressures in each district by addressing region-specific pest management challenges. The findings underscore the importance of timely pest monitoring and control measures to mitigate pest-induced yield losses and ensure sustainable sorghum production in the Cauvery Delta Regions of Tamil Nadu in India.

TS-I-25 (Short)

Analysis of airflow and mixture movement characteristics in sugarcane harvester extractor based on CFD-DEM

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Mechanized harvesting of sugarcane faces challenges such as high impurity and loss rates. The extractor's ability to remove impurities significantly impacts harvesting quality. However, observing the impurity removal process through experiments is difficult. Therefore, this study utilized computational fluid dynamics (CFD) and the discrete element method (DEM) to explore how different parameters of the extractor (including the number of blades, rotational speed, installation angle, and chord length) influence airflow and mixture movement, aiming to optimize performance. The number and installation angle of blades primarily affected the position and size of the low-speed vortex zone inside the extractor, thereby influencing the movement speed of sugarcane leaves. The extractor's rotational speed and blade chord length greatly influenced the trajectory of sugarcane leaves, significantly altering the number of leaves entering the extractor. Furthermore, simulation results indicated substantial depression at the installation position of the hydraulic motor atop the outlet chamber. Additionally, changes in the airfoil shape of the blade section at the leading and trailing edges could induce vortex formation and flow separation in the extractor, thereby affecting the movement of sugarcane leaves and increasing impurity levels. Hence, there exists significant potential for improving the extractor. This study will contribute to guiding the design and optimization of sugarcane harvester extractors.

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TS-II-01 (Lead)

Climate resilient sugarcane: Adaptive mechanism of thermo-tolerance

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Plants manifest different mechanisms for surviving under elevated temperatures, including long-term evolutionary phenological and morphological adaptations and short-term avoidance or acclimation mechanisms such as changing leaf orientation, transpirational cooling, or alteration of membrane lipid compositions. Globally, the first systematic study on thermo-tolerance for sugarcane was investigated through metabolomic, transcriptomic and proteomics approaches in seven commercial sugarcane genotypes and four wild species clones at two different growth phases. Accumulation of soluble sugars, soluble protein, total phenolics, proline, and glycine-betaine under heat stress has been reported in sugarcane, which entails great implications for heat tolerance. Based on the PCA analysis suggested that the traits lipid peroxidation, chlorophyll fluorescence, SPAD value, CSI, soluble protein, proline, leaf area & SCW are the potential physiological traits for screening varieties for thermotolerance. Identified HTI are being utilized for identifying the source of tolerance from the sugarcane germplasm pool. Provide a valuable resource for understanding the mechanism of heat stress tolerance in sugarcane and precise genome editing for improved stress tolerance of sugarcane. Next-generation sequencing method RNA-Seq to analyze the transcripts of sugarcane and characterized candidate genes related to the heat stress heat-tolerant sugarcane variety, Co 99004 and characterized candidate genes during the formative stage of growth. Identified several transcripts differentially expressed in treated compared to control, which annotated to involve in the response of oxidative stress (6), other abiotic stress (5) heat shock protein (3) and 1 in response to heat respectively. qRT-PCR and RT-PCR were used to validate the expression levels of 10 randomly selected transcripts and found high consistency between qRT-PCR and RNA-Seq methods. Protein identification and annotation of differentially abundant proteins revealed several mechanisms involved in high temperatures including their putative role in folding, sorting and degradation of HSP's, transcription and translational regulation of genes involved in cell growth and death, glycan biosynthesis and metabolism and signal transduction. Proteins with significant abundance included poly [ADP-ribose] polymerase 2-B (32.11 kDa), REF/SRPP-like protein cpx (21.65 kDa), palmitoyltransferase ZDHHC13 (8.88 kDa), putative F-box/kelch-repeat protein (31.56 kDa), putative cyclin-dependent kinase F-2 (7.68 kDa), thioredoxin O2 (12.72 kDa), BnaC05g49490D (25.42 kDa) and two hypothetical proteins. The gene encoding expression pattern in qRT-PCR and differential expressed abundant protein were found to be positively correlated in response to thermo-tolerance. These findings reveal novel targets for subsequent research on the genomics genetic manipulation and molecular mechanism of elevated stress tolerance in sugarcane.Co 99004 can be used for precise genome editing to improve sugarcane stress tolerance. Also, the identified transcripts may be used for gene pyramiding for developing climate resilience in sugarcane production. Researchers, sugarcane biotechnologists & Breeders and Industry.

TS-II-02 (Lead)

Assessment of drought tolerance of sugarcane (*Saccharum spp*) hybrids using physiological and yield traits

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Drought stress during the formative growth stage, the most sensitive stage for moisture stress in sugarcane is common in tropical regions which has a great impact on cane yield. The study was conducted at the Indian Council of Agricultural Research-Sugarcane Breeding Institute, Coimbatore, India and observations were recorded during the formative stage (60-150 days) in the field, both control and drought conditions during2020-2022 seasons. Data were collected over two years of field experiments on agro-physiological (stay green) traits. Hierarchical clustering analysis, utilizing stay-green traits, higher chlorophyll fluorescence ratio (F_v/F_m), leaf chlorophyll content (SPAD) and relative water content (RWC) and yield traits, cane yield, number of millable canes, cane height and cane volume, grouped 75 sugarcane hybrids into five major clusters both under non-stressed conditions and drought conditions. Cluster 2 contained the highest number of sugarcane genotypes (24), followed by cluster 3(17), cluster 1 (15), cluster 5(11) and cluster 4 (8). Cluster 1 was characterized by high F_v/F_m, SPAD, NMC, TDM, relative water content, and cane yield. Cluster 2 was dominated by F_v/F_m, SPAD, and TDMand cane volume. Cluster 3 was characterized by cane height, while cane yield and SPAD identified clusters 4 and 5.Drought-tolerant genotypes had higher values for SPAD, F_v/F_m, and RWC.A significant correlation was observed under drought for yield and stay-green traits.The first three PCs (PCA) accounted for the highest proportion of variance with PC1 for yield, NMC, and TDM, PC2 with F_v/F_m, PC3 on SPAD, and the fourth by cane volume. Clones 04-409, 04-73, 20-158, 13-457, 20-1132, 01-807, 14-54, 13-474,14-27, 13-455, 07-520, 20-112, 13-644 and 07-776 stayed green types with superior performance under stress with high yield, number of millable canes, cane height, cane weight, TDM, RWC and chlorophyll content, identified drought tolerant for deployment in climate-smart sugarcane breeding programs.

TS-II-03 (Lead)

Yield Performance of NSUT13-154, a promising sugarcane clone suitable for mechanical harvesting

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In Thailand, the sugarcane industry heavily relies on the Khon Kaen 3 (KK3) variety, which accounts for approximately 96% of the sugarcane output, followed by LK92-11. This monoculture raises significant biosecurity concerns and risks for the sugarcane industry, which also faces high production costs, particularly labor expenses. There is a need for sugarcane breeding to develop varieties that enhance yield and quality, suit specific regions, and compatibility with mechanized production, especially harvesting. Addressing these challenges, the Nakhon Sawan Field Crops Research Center (NSFCRC) of the Department of Agriculture (DOA) in Thailand has successfully bred and selected promising sugarcane clones. Among these, NSUT13-154, derived from parent varieties LK92-11 and UT84-10, has shown outstanding performance. NSUT13-154 was evaluated during the early generation

of selection at NSFCRC from 2013 to 2016, followed by extensive yield evaluations from 2017 to 2024, including preliminary, standard, and farm trials across 21 harvesting environments in plant cane and first and second ratoon crops. Results in yield traits demonstrate that NSUT13-154 outperformed standard sugarcane varieties KK3 and LK92-11, producing an overall mean cane yield of 100 t/ha, surpassing LK92-11 (89 t/ha) andKK3 (98 t/ha) by 12% and1%, respectively. Its sugar yield was 13.3 t/ha, 8% higher than LK92-11 (12.3 t/ha) but 4% lower than KK3 (13.9t/ha), while maintaining a Commercial Cane Sugar (CCS) of 13.3. Additionally, NSUT13-154 exhibited high germination, rapid tillering ability, and desirable features such as an erect canopy, uniform growth of main stems and tillers, a high stem formation rate with medium stalk size, and a strong root system contributing to lodging resistance. It also shows resistance against red rot wilt disease and produces fewer flowers. Given these positive traits, NSUT13-154, a promising new sugarcane clone, will be released to boost the profitability of cane growers, especially in central and northern Thailand. This development significantly contributes to meeting the needs of Thailand's sugarcane industry and related sectors.

TS-II-04

Integrated differential gene expression, TWAS and WGCNA analyses of a F1 population transcriptome identified key genes associated with sucrose accumulation in sugarcane

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Identification of key genes controlling sucrose accumulation is crucial for enhancing sucrose content in sugarcane using molecular technology. In this study, we conducted transcriptome analysis on an F1 population exhibiting significant variation in sugar content. High-quality reference transcriptomes were constructed for the parental lines, revealing maternal inheritance patterns at the molecular level in sugarcane F1 progeny. Through expression analysis across the population, we identified differentially expressed genes (DEGs): 311 in leaves, 278 in immature stems, and 58 in mature stems, with 57 DEGs involved in sugar metabolism. Using transcriptome-wide association study (TWAS), we found significant correlations between sucrose content and 8,909, 8,950, and 8,938 genes in leaves, immature stems, and mature stems, respectively, with 258 genes related to sugar metabolism. The weighted gene co-expression network analysis (WGCNA) identified 28, 31, and 14 gene modules from the three tissues, respectively, highlighting 25 hub genes associated with sugar metabolism. Integrating these approaches, we identified 270 non-redundant genes linked to sugar metabolism, from which overlapping analysis pinpointed 4 key genes crucial for sucrose accumulation. We investigated the transcription factor ScWRKY, observing its impact on sugar content through overexpression and silencing experiments. ScWRKY showed strong co-expression with genes involved in sugar metabolism, underscoring its regulatory role in sucrose accumulation. Overall, this study represents the first comprehensive population transcriptome analysis in sugarcane, unveiling key genes associated with sucrose accumulation. These findings provide valuable insights into molecular mechanisms underlying sugar metabolism and offer potential targets for genetic improvement of sugarcane.

TS-II-05

Activity of key enzymes and expression characteristics of related genes in nitrogen metabolism of sugarcane

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Improving nitrogen use efficiency (NUE) in sugarcane has long been a crucial area of research, aiming to enhance productivity while minimizing nitrogen inputs. This study focused on identifying key enzymes and genes influencing nitrogen metabolism in sugarcane, with implications for breeding nitrogen-efficient germplasm and optimizing cultivation practices. In this study, two varieties GXASF1-08-11(high NUE) and GT11(low NUE) were subjected to high N (ÿ5mM N) and low Nÿ0.2mM N ÿtreatment to investigate their growth performance, nitrogenase activity and changes in 8 N related genes. The results demonstrated that the total biomass, nitrogen accumulation, NUE of GXASF1-08-11 were 5.68 -18.119 %, 5.65-45.61%, 5.69-27.29% higher than those of GT11 during 60-90 days under high/low N conditions. And GS and GOAGT enzyme activities in leaves of GXASF1-08-11 were generally higher than GT11 under high/low N treatment during 60-90 days. Four genes associated with NH_4^+ absorption GS1,GS1.1,GS1.2,GS2, and five genes associated with NO_3^- absorption NRT1.1,NRT1.2,NRT2,NRT2.1NRT2.2 are all expressed at leaf, stem and root in two sugarcane varieties but show different response to growth period and N treatment. The expression level of GS2 in the leaves and stems of GXASF1-08-11 was much higher 0.93-97 folds than GT11 under different N treatment during 30-90 days. The expression level of NRT2 and NRT2.2 of GXASF1-08-11 were 0.49-20 and 0.4-51 folds higher than GT11 respectively in all organs during most growth stages under high and low N conditions. GS2,NRT2 and NRT2.2 have a very timely and good response to long-term N stress, which hints that these genes may play an important roles in regulating the NUE of sugarcane.

TS-II-06

A gibberellin biosynthesis enzyme-encoding gene, *ScGA20 oxidase1*, can enhance sugarcane growth through its involvement in phytohormones and growth processes

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Sugarcane is a globally vital sugar and energy crop, but its complex genetic background and limited genetic diversity hamper conventional breeding efforts to enhance yields. Molecular breeding offers a promising solution to boost sugarcane productivity. Gibberellin (GA) plays a critical role in plant growth and development, with GA20-oxidase being the most crucial enzyme in GA biosynthesis. In this study, we isolated the ScGA20ox1 gene (OR283803) from sugarcane. ScGA20ox1 is a hydrophilic 43.88 kDa protein. Introducing the ScGA20ox1 gene into sugarcane with a Ubi promoter led to genetically modified (GM) sugarcane with significantly higher ScGA20ox1 expression, elevated GA levels, and faster growth compared to wild types. Transcriptome analysis unveiled changes in various genes related to growth pathways due to ScGA20ox1 over-expression, including, 6 genes in brassinosteroid biosynthesis, 41 genes in plant hormone signal transduction, and 6 genes in nitrogen metabolism. These findings suggest that ScGA20ox1 enhances sugarcane growth by regulating genes associated with growth pathways. This work provides compelling evidence for sugarcane yield improvement through over-expression of the GA20ox1 gene, advancing our understanding of GA's role in the growth and identifying target genes for further yield improvement through molecular techniques.

TS-II-07

The protein Crp mediates transcriptional regulation of carbon and nitrogen metabolism in nitrogen-fixing bacterium DX120E and sugarcane

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Endophytic nitrogen-fixing bacteria play an important role in nitrogen fixation in sugarcane. However, the strains' survival and development within sugarcane are regulated by the mechanisms of carbon metabolite utilization, which has received high attention in the study of nitrogen fixation in sugarcane. The cyclic adenylate receptor protein Crp is a key factor in carbon catabolite repression in microorganisms. The protein Crp of the nitrogen-fixing bacterium *Klebsiella variicola* DX120E was studied to determine its chemotaxis ability, colonization in various tissues, and nitrogen fixation capacity. Additionally, the differential genes associated with carbon and nitrogen metabolism were analyzed using transcriptomics after co-incubating the strain with detoxified sugarcane seedlings. The findings indicated that the Crp mutant strain exhibited a diminished chemotaxis capacity, whereas its nitrogen fixation ability was improved. The colonization numbers in sugarcane roots and leaves fell by a factor of 1.55 and 2.11, respectively, after co-incubation of gene crp-deficient strain with sugarcane seedlings, compared to the wild-type strain. Nitrogen-fixing enzymes in sugarcane seedling roots inoculated with DX, "*crp* and c"*crp* were 1.06, 1.11 and 1.02 times higher than those without inoculation with nitrogen-fixing bacteria, respectively. Transcriptomic analysis showed that the main genes related to carbon metabolism were involved in carbon fixation, photosynthesis and carbohydrate metabolism, and most of them were down-regulated in sugarcane leaves. Nitrogen metabolism genes were mainly involved in nitrate transport, nitrate reductase (NR), nitrite reductase (NirA), GS, GOGAT, GDH and amino acid metabolism. Nitrogen metabolism-related genes were mostly down-regulated in sugarcane leaves and up-regulated in roots. A greater number of genes exhibiting differential expression were identified in the protein Crp deletion treatment than in the treatment with the wild-type strain. The results indicate a reciprocal interaction between carbon metabolism inhibition by nitrogen-fixing bacteria and sugarcane, which will lay a theoretical foundation for the efficient application of nitrogen-fixing bacteria in crops for production improvement.

TS-II-08

Metabolic and molecular diversity of tropical and subtropical sugarcane varieties at tropical climate

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Sugarcane is a C_4tropical plant and it grows well under tropical conditions all over the world covering major important countries. The tropical region shares about 45% of the total sugarcane area in India, and the rest 55% of the total cane area in the country is in the sub-tropical region *viz.*, U.P, Bihar, Haryana and Punjab. In India, the initial sugarcane cultivation was started in tropical regions and the systematic scientific breeding in the twentieth century has led to the release of numerous varieties suitable for cultivation of sugarcane in subtropical conditions. Both the tropical and sub-tropical agro-climatic regions face extreme climatic conditions resulting in a decline of physio-biochemical processes and finally low cane yield. The sugarcane genotypes grown in both regions have their separate physiological adaptive mechanism to respond and acclimatize to the different climatic conditions predominant in these regions. The current study was undertaken to understand the metabolic and molecular diversity of selected sugarcane clones grown in both the tropical and subtropical regions. Twelve sugarcane genotypes including six tropical and six subtropical clones were selected for the present investigation. The selected clones were analyzed for metabolic profiling such as Nitrate reductase, total protein and total phenol content. The tropical clones exhibited higher accumulation of nitrate reductase and total phenolic content. The molecular diversity was analysed using Sequence Related Amplified Polymorphic (SRAP) functional markers. The SRAP marker data was scored and used for deriving the phylogenetic tree using the R software package. The phylogeny showed a clear segregation of tropical and subtropical clones. The tropical clones formed a separate clade, and among the tropical clade Co 06022 and Co 11015 formed a separate group.

TS-II-09

The potential use of *Bacillus subtilis* isolates as bioprotectant against sugarcane smut and growth-promoting agent in sugarcane seedling

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Sugarcane smut is a fungal disease caused by *Sporisorium scitamineum*. This sett-borne pathogen can cause severe economic losses in the sugarcane industry, especially in ratoon crops. In recent years, as global warming continues to rise, smut has posed a major threat to sugarcane industries worldwide. Although this disease can be managed using fungicides, excessive use can lead to health hazards and environmental pollution. Biological control is considered a promising alternative approach to pesticides and plant resistance promoters for managing plant diseases. Several *Bacillus spp*. have been proven to be promising biocontrol agents for controlling numerous pathogens along with plant stimulating effect on growth and yield, in laboratory and field conditions. In this experiment, we examined the soil isolates, *Bacillus subtilis* for their antagonism towards pathogenic fungi, *S. scitamineum* and plant growth-promoting effects in sugarcane seedlings. Two *B. subtilis* isolates, No. 20 and No. 71, were chosen for the investigation based on their maximum antagonistic inhibition (80%) against *S. scitemineum* mycelial growth *in vitro* and high Indole acetic acid (IAA) production of 49.3 and 32.4 µg/ml, respectively. Antimicrobial and growth-promoting effects of these two isolates in plants were tested in the smut-infected sugarcane plants. In the experiment, the germinating seed setts of sugarcane var. Khon Kaen 3 were prior dipped in *S. scitamineum* spore suspensions at the rate of 10^5 and 10^8 spores/ml and incubated 24 hours for infection before soaking with *B. subtilis* suspensions at the rate of 10^6, 10^8 and 10^{10} cfu/ml in each treatment. The treated plants were grown for two months in the pots with spraying of the respective concentration of *B. subtilis* suspensions every 7 days interval. In the two-month seedlings, smut disease incidence in the control group was found at 90.80% while those with maximum disease inhibition were at 0.07% in the seedlings treated with 10^5 spores/ml of *S. scitemineum* combined with 10^8 cfu/ml of *B. subtilis* isolates. These treatments also showed improvement in plant height (46.35%), sprouting of clumps (85.74%) and Chlorophyll content (31.35%) as compared to their respective control group. Though the inhibition effects of the remaining sett treatments were in the range of 0.15% to 4.18%, but too high a concentration of the bioagent and pathogen affected plant growth and survival. It was noted that however, the gradual symptom of the disease and plant mortality reduced as compared to the non-treated groups. The result in this experiment revealed antagonistic effect of the two *B. subtilis* isolates against the pathogenic fungi, *S. scitamineum* as well as their plant growth stimulator in sugarcane seedlings. These two Bacterial isolates can thus be used as promising biocontrol agents to reduce the damage of smut diseases and efficient biofertilizer inoculants that promote plant growth in sugarcane.

TS-II-10

Biochemical and endogenous growth hormone changes during meristem tip culture of exotic and Indian clones of sugarcane

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Micropropagation is a well-adapted technique for sugarcane cultivation and reinvigoration. *In vitro* elongation is the crucial step for successful micropropagation. It depends on the exogenous and endogenous factors. Biochemical alterations and changes in endogenous growth hormone (GA_3) during meristem tip culture of 15 clones of exotic and Indian collections of *Saccharum officinarum L.* were ascertained at 30thday. Total sugars and reducing sugars were estimated through Anthrone method while soluble protein was determined by Bradford assay. The vigorous clones were analysed for GA_3 content through HPLC analysis. In the exotic clones, the lowest level of total sugars with 1.947 µg and 1.273 µg observed in Laukona and Chapina, respectively. Increase in total sugars ranged from 1.947 to 4.814 µg. NG 77-134 accumulated 10.975µg/200mg with 4.814µg increase of reducing sugars. Increase in protein varied from 0.542 to 0.796 µg. NG 77-134 showed higher level of 1.712 µg/ 200 mg tissue, with 0.796 µg increase of protein. In the Indian clones, increase in total sugars ranged from 3.374 to 6.927 µg/200 mg tissue. IND 04-1377 accumulated 9.700 µg with 3.559 µg increase in reducing sugars. Increase in reducing sugars ranged from 0.338 to 3.559 µg. The mean increase in protein content ranged from 0.622 (IND 01-1084) to 0.817 µg (IND 01-1116). GA_3 content in at 0th day was 8.26 µg while during elongation it was 14.86 and 4.52 µg in regeneration. Higher level of biochemical changes and GA_3 observed in IND 04-1377 and NG 77-134 indicates these clones as the most responsive clones for micropropagation and *in vitro* reinvigoration.

TS-II-11

Assessment of plant enzyme activities in sugarcane genotypes under sodic shrink-swell soil

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A field experiment was conducted to assess the plant enzyme activities in sugarcane genotypes grown on sodic soil during the preseason of 2015-16 at Post Graduate Instructional Farm, Department of Soil Science and Agricultural Chemistry, Mahatma Phule Krishi Vidyapeeth, Rahuri. The experiment was laid out in randomized block design comprising 27 sugarcane genotypes with two replications. The experimental soil was clay fine montmorillonite, is ohyperthermic family of *Sodic Calciustert* and calcareous in nature with pHs 8.64, ECe 3.56 dS m^{-1}, exchangeable sodium percentage (ESP) 18.68 with high cation exchange capacity (CEC) 52.29 C mol (p+) kg^{-1} having swell-shrink property and categorized as sodic soil. Enzyme activities *viz.*, ascorbate peroxidase (APX), superoxide dismutase (SOD), nitrate reductase (NRA) and lipid peroxidase (LPO) along with chlorophyll content were assayed at 75 and 240 days after planting (DAP).

The NR activity was found significantly higher in the sugarcane genotype CoM 0265 (0.86 and 0.74 µMole nitrite produced g^{-1} fr. wt. hr^{-1}) which was followed by MS 6847 (0.84 and 0.72 µMole nitrite produced g^{-1} fr. wt. hr^{-1}) and MS 10001 (0.79 and 0.68 µMole nitrite produced g^{-1}fr.wt.hr^{-1}) at 75 and 240 DAP respectively. The sugarcane genotypes *viz.*, CoM 0265, MS 6847 and MS 10001 recorded higher activity of APX at 75 DAP (2.84, 2.77 and 2.58 µmole ascorbate oxidized mg^{-1} protein min^{-1} respectively) and at 240 DAP (2.62, 2.52 and 2.38 µmole ascorbate oxidized mg^{-1} protein min^{-1} respectively). Further, the SOD activity in MS 6847, Co 99004 and CoM 0261 were higher at 75 DAP (8.64, 7.86 and 7.85 units mg^{-1} protein respectively) and at 240 DAP (6.95, 6.71 and 6.88 units mg^{-1} protein respectively) than rest of the genotypes. However on the contrary, LPO activity (membrane damaging enzyme) was recorded statistically lower in CoM 0265, MS 6847 and MS 10001 at 75 DAP (0.97, 1.08 and 1.18 µmoles MDA g^{-1} fr. wt.) and at 240 DAP (0.81, 0.91 and 0.99 µmoles MDA g^{-1} fr. wt.) respectively. Significantly higher chlorophyll content was also recorded by CoM 0265 and MS 6847 than rest of the genotypes. The sugarcane genotype CoM 0265 recorded the highest total chlorophyll content at 75 and 240 DAP (2.08 and 2.28 mg g^{-1} fr. wt.) followed by MS 6847 (2.03 and 2.17 mg g^{-1} fr. wt.).

The higher cane and commercial cane sugar yield was recorded by CoM 0265 (164.70 and 21.90 MT ha^{-1}), while at par results were obtained by MS 6847 (131.90 and 14.58 MT ha^{-1}), CoM 10051 (128.27 and 15.86 MT ha^{-1}) and MS 10001 (100.91 and 14.84 MT ha^{-1}).

TS-II-12

Comparative impact of changes in yield attributes on relative contribution to productivity of sugarcane

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The assumed variation in mean yield attributes (millable cane number/ac, internode number/cane and weight/internode) of sugarcane from normal (40000 millable cane number/ac, 20 internodes/cane and 50g/internode), expected due to diverse environmental impact, brought out that mean millable cane yield (40t/ac) of sugarcane is highly sensitive to effect on millable cane number/ac accounting 31.2% yield loss followed by weight/internode causing 32.5% yield reduction (than normal 40t/ac), owing to variation, when evaluated singly and individually with remaining attributes assumed normal. When two attributes were considered affected together and simultaneously due to environmental impact, the mean yield loss rose to 55.6% over normal (40t/ac) which was equal to the effect on all three attributes together. Influence of environment on internode number/cane alone didn't affect yield adversely than normal (40t/ac) with mean cane number/ac and weight/internode (40000/ac and 50g/internode respectively) remaining normal and unchanged. But deviation of mean internode number and weight /internode together (38.1%) as well as that of cane number/ac and internode number/cane (36.8%) simultaneously over normal (40000 millable canes/ac, 20 internodes/cane and weight 50g/internode) impacted yield loss almost similarly compared to normal (40t/ac). The cane number/ac and weight/internode with normal internode number/cane (20) impact yield loss of sugarcane to greater magnitude due to variation in three traits.

TS-II-13

Advancing nutrient economy and increasing sugarcane yield by application of consortium of beneficial soil microorganisms and consortium endophytic Nitrogen fixing bacteria

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Agriculturally beneficial microorganisms play a key role in making available nutrients from soil & atmospheric air (especially nitrogen). Various types of bacteria, fungi, yeast and Mycorrhiza make available nutrients from soil to crop by various mechanisms. Application of one type of bacteria at a time is laborious & not economical, so one can plan to use microbes in the consortium to solve the problems. The atmosphere is highly rich in nitrogen & is converted to readily available nitrate form by endophytic bacteria symbiotically. *Acetobacter, Azospirillum, Burkholderia, Azoarcus* & *Herbaspirillum* spp. can colonize the root interior and aerial tissues of the crops. The ability to colonize the entire plant interior and locate themselves within niches makes them the most promising group of diazotrophs. It has been reported that endophytic nitrogen-fixing bacteria can save inorganic nitrogen fertilizers by foliar application. VSI has developed a consortium of soil microorganisms and endophytic Nitrogen fixers. The field research trials were conducted for three seasons in nutrient-exhausted soil for evaluation of the effect of application of consortium of beneficial soil and consortium endophytic nitrogen-fixing bacteria revealed that significantly highest cane & CCS yield **(140.50 & 22.74 t/ha)** was found where drenching of the consortium of soil microorganisms @ 10 lit./ha at planting, 30,75, & 120 DAP and foliar application of consortium of endophytic Nitrogen fixing bacteria @ 2.5 lit./ha at 60 DAP with 0% N & 50 % PK over to control (100% RDF) where cane & CCS yield **(125.47 & 19.80 t/ha)**. It can be concluded that a consortium of soil microorganisms and endophytic nitrogen-fixing bacteria can save 75% inorganic nitrogenous and 50% Phosphatic & potassic fertilizers with sustainable cane and sugar yield.

TS-II-14

Green technology to improve early growth in sugarcane : Impact of naturally derived bio-stimulant DPV application under sub-tropical conditions

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Preliminary trials were conducted with a naturally derived bio-stimulant (DPV – Universal Plus; DPV – U+)* to assess it growth promoting response on sugarcane under sub-tropical conditions. Two early maturing sugarcane varieties, CoLk 14201 and Co 0118 were raised as per the standard cane husbandry practices in the farmers' fields at Bhaudiya Kalan village, Lakhimpur Kheri, U.P., India. Sugarcane variety CoLk 14201 was planted in autumn (October 28, 2024), and Co 0118 in spring (March 28, 2024). DPV granules were applied at 4 kg/acre, 120 days post-planting, followed by hoeing. Initial observations (July 2024) in CoLk 14201 indicated that the DPV-treated plants showed significant improvements in tillers per clump to the extent of 15.4%, increase in NMC around71.4 % , increase in cane height varied from 16.7-25.1%, and improvement in cane girth ranged between 11.4-14.3%, over untreated control. Similarly, in variety Co 0118, DPV-treated plants exhibited increase in tillers over 100%, cane height increased around 49.7%, and increase in cane girth was 28.6%, over the untreated control. Our initial observations show that the application of DPV – U+ resulted in a significant increase in the tiller number, NMC , and overall cane dimensions (height and girth). The indicative improvement in these agronomic traits will have marked impact on yield and CCS per hectare at final harvest. The product's unique combination of bioactive compounds, phytohormones, and elements, particularly potassium, seems to have contributed to enhanced extension growth and reduced tiller mortality. Additionally, the bio-stimulant's unique smellrepelled insectsto some extent, providing a biocontrol umbrella to crop. Studies are underway and a foliar application of DPV – U+ (500 ml/acre) will be given at 180 DAP to further assess its impact on crop quality and yield at final harvest. Field trial results suggest that DPV – U+ has the potential to significantly enhance sugarcane productivity and quality, aligning with Vijasu Ecotec's commitment to green &sustainable sugarcane farming.

TS-II-15

Enhancing resilience in agriculture through sugarcane based intercropping for improved crop yield

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In India, the continuous decline in land holdings due to rising population pressure demands innovative strategies to ensure food and enhance livelihoods. Sugarcane-based intercropping systems emerge as a viable solution to these pressing challenges by improving both crop productivity and system resilience. By intercropping various crops such as wheat, pulses, oilseeds, potato, and spices between rows of sugarcane, farmers can significantly boost the productivity and profitability of their sugarcane-based cropping systems. This method not only maximizes land use efficiency but also enhances overall yield and economic returns compared to sole sugarcane cultivation. Research demonstrates that integrating these crops with sugarcane, particularly when using autumn-planted sugarcane in furrow-irrigated raised-bed systems, offers substantial benefits. This setup allows for optimized use of irrigation resources, reducing production costs, while enhancing crop yields. The irrigation provided for sugarcane also supports the growth of component crops, thereby increasing the overall productivity of the system.

Moreover, the inclusion of pulses in these intercropping systems is particularly advantageous. Pulses contribute to improved soil fertility and sustainability, which are critical for maintaining long-term agricultural resilience. By enhancing soil health and promoting sustainable practices, intercropping with pulses helps in building a more healthy and resilient agricultural ecosystem. This paper investigates into the potential of sugarcane-based intercropping systems to address the challenges faced by Indian agriculture. It highlights agronomic interventions and research findings that demonstrate how these systems can lead to increased crop yields, improved farmer incomes, and more sustainable agricultural practices. By adopting these practices, farmers can achieve a more productive and resilient farming system, essential for addressing food security and economic stability in the face of shrinking land resources.

TS-II-16

Effect of water stress on growth and yield for different sugarcane varieties

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Sugarcane is commercial, long duration crop, requires large amount of water for its growth and development and the crop requires from 148-300 g to produce 1g dry matter under different situations. Water stress is being one of the main limiting factors of growth and productivity. This abiotic stress normally coincides with formative stage of sugarcane which is sensitive and critical stage for growth and yield. Water use efficiency is a crucial characteristic when selecting drought–resistant varieties. Drought–tolerant sugarcane genotypes exhibit higher intrinsic instantaneous water use efficiency, along with the ability to maintain higher water potential and photosynthetic capacity during water deficit conditions. The study was conducted at Agricultural Research Station, Basanthpur –Mmamidigi, to evaluate variation in the tolerance to water deficit among ten sugarcane clones by with holding moisture in the soil during formative stage and climate conditions. The date recorded on morphological parameters such as leaf length, leaf width, leaf area, stalk diameter, cane height, cane weight, internodes number and average internodal length. total root weight, dry matter production of stalk, leaves and roots were observed. The results indicated that the rate of photosynthesis, transpiration rate, and stomatal conductance of decreased for all sugarcane clones after inducing water stress . Among the different sugarcane clones 2013 R 81 and Co 87025 found tolerance to water stress indicating less reduction in yield (14%) compared to other varieties, which further confirm their drought tolerant behavior. Since, the water stress also leads to reduction in photosynthetic rate due to decrease in stomatal conductance. However, it also influences on other parameters such as cane height, Internodes number and internodal length. This implies that there are more morphological losses in canes exposed to drought condition.. This will contribute to more losses in production, productivity and yield of sugarcane grown under drought conditions. The quality parametres such as sucrose percent in juice was not affected significantly due to water stress.

TS-II-17

New approach for silicon supply mitigates drought stress on *Saccharum* spp. by modulating growth, photosynthetic and antioxidative enzyme activities

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Saccharum spp. hybrid is a major cash crop for sugar and ethanol production worldwide and requires essential nutrients for maximum yield. It is a C_4 plant based on specific carboxylation profile having four developmental phases, viz., sprouting, tillering, major growth period, and maturity, which experiences different degrees of water stress to affect plant development. These growth phases get affected by limited irrigation, which causes loss in plant development and productivity. An extension in cropping areas for sugarcane cultivation has acquired serious attention these days to use upland where insufficient soil moisture prevails as adverse environmental factor for its production. The sugarcane plant growth developmental phases get affected by environmental temperature and irradiance. Silicon (Si) is an ubiquitary constituent and the next most abundant after O_2 in soil. It is a major constituent (28% on the basis of dry mass) of the planet, forming the silicate minerals, i.e., silicate or aluminum silicate, which may be differentially absorbed by the plants. The various forms of silicon could be used as an environmental stress mitigator, as shown by enhanced plant growth, development, and productivity during adverse environmental variables. Present study aims to reveal the consequences of foliar spray of silicon (Wollastonite, $CaO.SiO_2$) to alleviate the adverse effects of limited water supply in sugarcane. Silicon (0, 50, 100 and 500 ppm) was applied as foliar spray on normally grown 45 days old sugarcane plants. Further, these plants were raised at half field capacity (50%) using water irrigation precisely up to 90 days under open environmental variables. The stressed plants down-regulated P_N (28-31%), gs (31-41%) and E (50-54%). WUE_i and WUE were found higher (1.3-17 & 40-55%) in sugarcane plants as compared to normal plants after applying Si (50, 100 and 500 ppm). The higher leaf respiration *Rd* values were also noticed at 30, 60 and 90 days after foliar application of Si in stressed plants, varied significantly among Si application during specific time of stress. The foliar application of Si alleviated *Rd* ca. 18-46% during stress almost found similar to gs values in comparison to control and stress condition. The average gs values at night were lower than during the day (30, 60 and 90 days) in stressed and Si applied plants, while gs varied significantly during the daytime.

Dark-adapted *Fv/Fm* downregulated (11-~14%) at 30, 60 and 90 days after stressed condition. The highest reduction (~14%) was found in 90 days after stress, and minimum loss (10-13%) was found in limited irrigation of water with Si application (50, 100 & 500 ppm). The relative leaf water content (RLWC) was reduced by 29-34% on various days after stress. On the other hand, leaf area-expansion (LAE) of sugarcane plants decreased by limited irrigation, and maximum loss was found (51%) at 90 days after stress compared to control. Foliar spray of Si alleviated 15-51% loss in LAE in stressed plants. Si mitigated the Chl a, Chl b, Chl a+b, and SPAD units by 3-25, 2-24, 3-25 and 7-18%, respectively, in stressed plants. The biomass of leaf, stem, senescence leaves and total biomass reduced ca. 42-44, 56, 53-63 and 44-53% at 30, 60 and 90 days after stress, respectively. The loss in biomass was significantly mitigated and gradually enhanced upon Si application. The antioxidative enzyme activities such as CAT, SOD and APx were significantly enhanced in response to stress with or without Si. The maximum limited irrigation-induced CAT (102-132%), SOD (34-98%) and APx (21-136%) activities. However, the various concentration of Si (50, 100 & 500 ppm) showed a quite different pattern for improving the activities of various antioxidative enzymes. SOD activity increased (26-98%) with increasing Si levels. The CAT activity pattern was found to be similar to SOD with enhancing (67-131%) tendency associated with Si. Ascorbate peroxidase (APx) activity was evidently positively regulated by Si, which enhanced up to ca. 133-259%. The foliar spray of Si defended sugarcane plants from limited water irrigation stress as Si quenched the harmful effect of water deficit and enhanced the operation of antioxidant defense machinery for improved sugarcane plant performance, suitably favored stomatal dynamics for photosynthesis and plant productivity.

TS-II-18 (Short)

Rapid evaluation of sugarcane growth and nitrogen use efficiency based on two- dimensional automated image-based phenotyping

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Nitrogen plays a crucial role in sugarcane nutrients. Nitrogen fertilizer over-used and soil N inefficient have been important factors restricting the yield improvement of sugarcane in Guangxi province which the sugar industry accounts for more than 60% of China's. Screening sugarcane varieties with improved nitrogen use efficiency (NUE) provide a promising strategy in breeding to balance the contradiction between yield, soil and environment. Phenotyping methods have become more and more important along with molecular and genetic approaches. The objective of this paper was to establish a rapid, high-throughput screening method to enable genomic selection in sugarcane. In this study, two sugarcane varieties GXASF1-08-1-11(high NUE) and GT11 (low NUE) obtained from previous screening tests were used as research subjects, experiments conducted in a greenhouse using an automated image-based phenomics platform at Sugarcane Research Institute, Guangxi Academy of Agricultural Sciences under different N levels (0.01mM -24 mM). The results showed that the biomass of the two varieties increased with the increase of nitrogen application amount. Significant ($p < 0.05$) treatment and genotype by treatment interactions for dry matter yield and NUE were observed. Of the 15 plant architecture features directly extracted from image analysis. There was abundant variation among phenotypic traits and the coefficient of variation was between 0.59 ~ 87.13%. 8 common factors with characteristic factors greater than 1 were extracted by factor analysis, and the cumulative variance contribution rate was 91.18%. The projected area, development degree, vertical distance, outer polygon circumference and minimum outer circle diameter were selected as the representative indexes for the phenotypic evaluation of sugarcane growth and nitrogen utilization. The experimental results provide a theoretical reference for the rapid assessment of sugarcane growth and nitrogen utilization rate by two-dimensional phenotypic image traits.

TS-II-19 (Short)

Indexing sugarcane phytoplasmas by applying 16S rRNA and *secA* gene specific primers in weed species growing in sugarcane fields of Uttar Pradesh

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During survey of sugarcane fields in Uttar Pradesh, sixteen different weed species were found exhibited typical phytoplasma suspected symptoms of little leaf, leaf yellows, chlorotic leaves, witches' broom, grown in and around sugarcane fields. The symptomatic weeds were indexed for phytoplasma association and their role as alternative reservoirs of sugarcane grassy shoot (SCGS) and sugarcane leaf yellows (SCLY) phytoplasmas. Out of sixteen weed species, nine species (*Phalaris minor, Cynodon dactylon, Parthenium hysterophorus, Digitaria sanguinalis, Digitaria ciliaris, Eleusine indica, Oplismenus burmannii, Dichanthium annulatum* and *Cannabis sativa*) were identified positive for association of three different phytoplasma subgroups *viz.*, 16SrI-B, 16SrII-D and 16SrXIV-A by utilizing 16S ribosomal gene specific primer pairs (P1/P7 and R16F2n/R16R2). Additionally, *secA* gene sequence analysis corroborated the 16S rDNA results, consistently characterizing all phytoplasma isolates identified with 16S ribosomal gene specific primers in symptomatic weeds into the same subgroups (16SrI-B, 16SrII-D, and 16SrXIV-A). Association of 16SrI-B subgroup phytoplasma in *Phalaris minor* weed species was noticed important because the same subgroup was identified associated with SCLY disease of sugarcane, which suggests possibility of transmitting this strain to other sugarcane varieties through leafhoppers and needs further investigation. Our study suggested the validity and sensitivity of *secA* gene specific primers for authentic characterization of phytoplasmas strains of 16SrI-B, 16SrII-D and 16SrXIV-A subgroups associated with different weed species.

TS-II-20 (Short)

Productivity and profitability of sugarcane with foliar application and sett treatment of potassium salt of active phosphorus (PSAP) in the peninsular zone of India

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A field experiment was conducted at Agriculture Research Station, Sankeshwar Tq.: Hukkeri Dist.: Belagavi, Karnataka, India during 2020-21 and 2021-22 to evaluate the efficacy of Potassium salt of Active Phosphorus (PSAP) on yield and economics. The experiment was laid out in randomized block design with three replications. Ten treatments of PSAP with sett soaking and foliar application methods were evaluated in the study. Treatments *viz.,* Recommended dose of NPK (RDF) (T_1), RDF + sett soaking with 0.8 per cent PSAP solution (T_2), Recommended N, 50 per cent P and 50 per cent K (T_3), T_3 + sett soaking with 0.8 per cent PSAP solution (T_4), T_2 + Foliar spray of PSAP @ 0.4, 0.65 and 0.80 per cent at 60, 90 and 120 DAP (T_5), T_2 + Foliar spray of PSAP @ 0.4, 0.65 and 1.10 per cent at 60, 90 and 120 DAP (T_6), T_2 + Foliar spray of PSAP @ 0.4, 0.65, 1.10 and 1.10 per cent at 60, 80, 100 and 120 DAP (T_7), T_4 + Foliar spray of PSAP @ 0.4, 0.65 and 0.80 per cent at 60, 90 and 120 DAP (T_8), T_4 + Foliar spray of PSAP @ 0.4, 0.65 and 1.10 per cent at 60, 90 and 120 DAP (T_9), T_4 + Foliar spray of PSAP @ 0.4, 0.65, 1.10 and 1.10 per cent at 60, 80, 100 and 120 DAP (T_{10}). Pooled data indicated that sett soaking with 0.8 per cent PSAP solution with the recommended dose of fertilizer followed by foliar spray of PSAP @ 0.4, 0.65, 1.10 and 1.10 per cent at 60, 80, 100 and 120 DAP recorded significantly higher cane yield of 144.7 t ha^{-1} and higher net returns of Rs 2,75,201 ha^{-1} than other treatments. Cane yield recorded a 13.3 per cent enhancement over the recommended dose of fertilizers. Over and above the recommended dose of fertilizers along with PSAP sett soaking and foliar application has resulted in increased yield and monetary advantage over the recommended dose of fertilizers

TS-II-21 (Short)

Productivity of sugarcane as influenced by soil and foliar application of silicon in peninsular zone of India

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The field experiment was conducted during 2021-22 and 2022-23 to study the influence of silicon foliar and soil application on physiological parameters and yield of sugarcane at ARS, Hukkeri, Karnataka. The experiment was laid out in split plot design with two soil application of silicon (Si) as main plots and eight foliar application of silicon as sub plots along with control (recommended package of practice). The main plot treatments were *viz.*, soil application of Diatomaceous earth (DE) containing 60% SiO_2 @ 300 (S_1) kg ha^{-1} and 450 (S_2) kg ha^{-1}, respectively. Sub plot treatments were foliar application *viz.*, F_1: Hydrated aluminium silicate (HAS) containing 60% SiO_2 @ 0.25% at 60 days after planting (DAP), F_2: HAS @ 0.25% at 90 DAP, F_3: HAS @ 0.5% at 60 DAP, F_4: HAS @ 0.5% at 90 DAP, F_5: Ortho silicic acid (OSA) containing 2% Si as H_4SiO_4 @ 0.2% at 60 DAP, F_6: OSA @ 0.2% at 90 DAP, F_7: OSA @ 0.4% at 60 DAP and F_8: OSA @ 0.4% at 90 DAP. Among soil applications, DE @ 300 kg ha^{-1} recorded significantly higher cane yield (143.1 t ha^{-1}), SPAD value (41.58), stomatal conductance (0.47 mmol $m^{"2}$ $s^{"1}$) and net returns (¹ 2,82,403 ha^{-1}) with lower proline content (0.19 µg g^{-1}). Among foliar applications, OSA @ 0.2% at 60 DAP recorded significantly higher cane yield (148.3 t ha^{-1}), SPAD value (42.60), stomatal conductance (0.48 mmol $m^{"2}$ $s^{"1}$) and net returns (¹ 2,88,062 ha^{-1}) with lower proline content (0.18 µg g^{-1}). Among interactions, soil application of DE @ 300 kg ha^{-1} along with foliar application of OSA @ 0.2% at 60 DAP recorded significantly higher cane yield (159.0 t ha^{-1}), SPAD value (44.90), stomatal conductance (0.52 mmol $m^{"2}$ $s^{"1}$) and net returns (¹ 3,26,974 ha^{-1}) with lower proline content (0.13 µg g^{-1}) and it was on par with soil application of DE @ 300 kg ha^{-1} along with foliar application of HAS @ 0.5% at 60 DAP. This increase in cane yield was due to sufficient availability of nutrients and soil moisture at root zone to meet the crop demand during the entire life cycle along with better sunlight and aeration resulting in better yield attributes. The losses in photosynthetic and biochemical parameters due to water stress were alleviated by Si application. The Si application improves the plant growth and development under stress, accompanied with the up-regulated photosynthesis, stomatal conductance, transpiration rate, photosynthetic pigments such as Chlorophyll a, b, a+b, relative water content, biochemical activities, *viz.,* catalase, peroxidase and superoxide dismutase and decreased proline content.

TS-II-22 (Short)

An appraisal of parents and their progenies for yield and quality traits in sugarcane (*Saccharum spp*)

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Improvement in sugarcane depends on genetic diversity existing in the parental pool and the choice of parents used in hybridization programmes.Many parents have been used in the breeding programme at ICAR-SBI and hundreds of cross combinations have been effected, with majority of the best varieties have come from a relatively few parents and crosses.The objective of this study were to evaluate parents using progeny data obtained from breeding populations.Data for number of millable canes, cane diameter and HR brix were collected from 50 progenies per family. Progenies from parental clones *viz.,* Co 0314, Co 8371, Co 85019, Co 86010, Co 98010, Co 11015, Co 12014, Co 13014, CoC 671, ISH 100, Co 86032, Co 86011, CoPant97222, Co 10033, Co 10026, CoVC 14061, CoM 0265 promising for yield and quality traits produced more seedlings,can be studied further to ascertain their stability.Progeny data from 25 crosses indicated that Co 11015 is one of the most outstanding parents followed by Co 86032,Co 86011,Co 775, CoC 671and CoVC 14061.Co 94008 and Co 12009 were found to be good source of red rot resistance, when crossed with moderately susceptible clones produced higher frequency of resistant progenies.Interestingly,Co 11015 gives fairly large number of progenies with high values of HR brix when used as a male parent with several pistil parents and also as a female parent with several pollen parents indicating its high breeding value for transmitting sucrose traits to its progenies.Parents of recent years and their progeny studies indicate Co 11015, Co 12014, Co Pant97222 as very valuable parents to create variability.Investigation suggest that with focused parent evaluation and identification of elite parents will increase efficiency of the breeding programmes.Parents capable of producing superior progenies identified in this study can be used for building a better breeding gene pool for sugarcane improvement.

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TS-III-01 (Lead)

Optimizing steam consumption and bagasse saving in sugar complex "A technical approach"

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Efficient utilization of steam and saving of bagasse are critical factors in enhancing the sustainability of sugar plants. This paper explores various strategies and technologies aimed at reducing steam consumption while maximizing bagasse saving. Therefore, while setting up our Greenfield sugar complex of 7500 t cane/day sugar with 120 KLPD ethanol plant for Bindal Paper Mills Ltd. in Uttar Pradesh (India), the key areas of focus include process optimization, advanced control systems and innovative equipment designs. A septuple-effect falling film evaporator set, condensate-flash recovery system, batch pan design on 5th effect vapour, vertical continuous pan designed on 6th effect vapour, double stage condensate heating extensive vapor bleeding, steam saving devices like direct-contact heaters, molasses conditioning, cigar, PHEs, waste heat recovery system for sulphur burning were installed. We have achieved less than 26.5% steam consumption on cane during the first crop (2023-24) and we hope to better this figure during the next season. Case studies and empirical data from operational implementations are presented to illustrate the effectiveness of these approaches. The findings underscore the potential for significant economic and environmental benefits through improved energy efficiency and resource utilization in sugar plant operations

TS-III-02 (Lead)

Sugar industry – sustainability through cost curtailment

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Cost reduction in sugar industry is imperative for the sustainability of industry considering the higher raw material cost, conversion cost and lower sugar price. Cost cutting is to be done by adopting creative ways. For the sustainable profitability, it is necessary to adopt the new technologies and inventive ways for the cost curtailment. There are two ways to maximize profit of organization. First one is to increase selling price of finished product by improving the quality and second one is to reduce production cost by implementing appropriate or innovative measures.

Value addition to the final product is another way to get the respectable price and it can be achieved by producing refined sugar suitable to the requirement of institutional customers. Other alternatives are production of organic sugar, liquid sugar, cube sugar, sugar sachet etc. as per market demand. It is also necessary to make the sugar mill as a hub to produce Sugar & Bio products using various by products. Various bio products are like Bio Plastic, Paper, Cutlery, Apparel fabrics,Furfural, Surfactant from Bagasse & Bio CNG, Bio Wax, Bio Manure from Filter cake and Dry potash from Spent wash etc. Producing green hydrogen, aviation fuel from the byproducts of the sugar mill is the another area having scope for the value addition.

Along with improving the sugar yield and quality, it is also essential to modernize the plant and its operations for optimizing the production cost. It can be achieved by implementing various measures like improving the raw material quality, increasing capacity utilization, reducing the energy consumption, value addition, production of biofuel, improving the technical performance, implementing automation techniques, preventive maintenance and thus reducing the repairs & maintenance cost.

TS-III-03 (Lead)

Multiple avenues of green hydrogen generation in sugar mills

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India, being in the tropical zone, offers an excellent environment for sugarcane for renewable energy and high sun irradiance for solar energy. Also, the western states have more than 7,000 kilometres of coastline along the edge of the sea, which provides consistent wind flow for wind energy. Moreover, it also offers a large number of rivers that run year-round and the ability to produce hydal power.

In January 2023, the Indian government declared the national green hydrogen mission, which aims to produce a minimum of 5 million metric tons of green hydrogen by 2030. Furthermore, the goal is in line with an objective of about 125 GW capacity of related renewable energy. Green hydrogen is defined by the Ministry of New and Renewable Energy as, having a well-to-gate emission of no more than 2 kg CO_2 equivalent per kg H_2 as a 12-month average (MNRE posted on 19th Aug 2023 by PIB Delhi). This includes water treatment, electrolysis, gas purification, drying and compression of hydrogen. Green hydrogen production will have some opportunities due to the integrated nature of sugar mills, by-product co-generation and ethanol production.

India currently produces hydrogen through the combustion of fossil fuels using steam methane reformation (SMR). In sugar mills, other methods can be used for producing hydrogen, including pyrolysis of bagasse, water electrolysis using excess electricity from co-generation, bio-photolysis of bagasse, press mud and molasses using both biological and thermo-chemical components.

There are multiple avenues for hydrogen production in sugarcane mills and their co-generation entities, the best approach would likely be a combination of methods tailored to the specific conditions and resources of each mill. From this simple calculation, hydrogen production from bagasse seems potentially profitable with a short break-even time. However, this is a very simplistic view. In the real world, considerations like fluctuating market prices, equipment maintenance, variations in sugarcane yield and technology efficiencies will play a role. For an actual project, a detailed feasibility study involving all technical, economical, environmental and logistical aspects would be necessary.

TS-III-04 (Lead)

Green hydrogen: A sustainable opportunity for sugar & distillery industry

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In future, renewable energy sources like hydrogen will play a significant role in world energy requirements. Hydrogen is one of the clean fuel options for reducing motor vehicle emissions. India consumes about six million tonnes of hydrogen every year for the production of ammonia and methanol in industrial sectors, including fertilisers and refineries. This could increase to 28 million tonnes by 2050, principally due to the rising demand from the industry and the expansion of transport and power sectors. As India's hydrogen demand will increase five-fold by 2050, India has set a target of 80% green hydrogen production with respect to its total demand to reduce carbon emissions. The sugar industry has an excess of power/electricity generated after captive consumption. Excess electricity is sold to the grid. Day by day the tariff for electricity is going down. The sugar industry is looking for economically viable alternatives like hydrogen production using water electrolysis with electricity. Bagasse (carbon neutral energy source) can be also used for hydrogen production using gasification. In addition, bagasse, press mud cake and spent wash can be used for biogas (60-65 % methane) production using anaerobic digestion. Steam Methane Reforming can be used for the production of hydrogen from methane/biogas. Preliminary techno-economic analysis for green hydrogen production was performed. For hydrogen production plants using water electrolysis, the payback period will be around 5 years with a minimum capacity of 5 tons/day.

TS-III-05 (Lead)

Phytopharmaceutical importance of sugarcane and its potential health benefits

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Sugarcane, *Saccharum officinarum* Linn. belonging to family Poaceae, is an important perennial grass. Sugarcane is the most important commercial crop known to be under cultivation in India since time immemorial. Based on its economical and medicinal values it is cultivated throughout the world. Sugarcane juice is well recognized raw material for the production of refined sugar and its wax is considered as a potential substitute for the expensive carnauba wax, which has pharmaceutical and cosmetic importance. It has been traditionally claimed for its medicinal potentials for jaundice, haemorrhage, dysuria, anuria, and other urinary disorders. Its phytopharmaceutical importance and health benefits are due to the presence of various secondary metabolites including fatty acid, alcohol, phytosterols, higher terpenoids, flavonoids, -O- and -C-glycosides, phenolic acids etc. Sugarcane juice and its unrefined products including brown sugar, molasses, and jaggery are the potential source of phenolic acids, flavonoids, and different glycosides. Sugarcane wax has been reported for its pharmacological activities such as sympathomimetic, antihypercholesterolemic, antithrombotic potentials. Sugarcane roots, stem and its products such as juice, sugar, and jaggery are well known for their nutritional and therapeutic effects in folk and traditional system of medicine. The sugarcane juice and jaggery have various bioactivities like anti-inflammatory, analgesic, anti-hyperglycaemic, diuretic, antiseptic, antioxidant, antimicrobial, cardioprotective properties. My talk will cover phytopharmaceutical importance of sugarcane and its potential health benefits.

TS-III-06 (Lead)

A success story of conversion of DS process to refined sugar with mud removal system at Saraswati Sugar Mills

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There are several sugar mills that have been converted from the common, decades old Double sulphitation process to full-fledged Refineries manufacturing sugar as per the international standards. During the season 2023-2024 Chemical Systems Technologies converted the process at the SSM (Saraswati sugar mill) -10000 TCD Plant. Besides installing the standard decolorization stages of phospho-flotation and ion exchange there were two significant steps added that not only improved the return in investment but also made the factory to more energy efficient while making it more green and environment friendly. The two additions are a Decanter based mud removal systems (MRS) that totally replace the existing rotary vacuum filter (RVF) and a Zero Liquid Discharge (ZLD) systems for the effluent generated during the ion exchange steps. The paper describes these two in details along with the impact on the projectioning.

TS-III-07

Development of sugarcane deep processing and comprehensive utilization in China

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The sugar industry plays a crucial role in China's economic development and people's livelihoods, with Guangxi province being the leading producer, contributing over 60% of the country's total sugarcane planting area and sugar output. In recent years, there has been significant growth in research and industrialization focused on the intensive processing and comprehensive utilization of sugarcane as a raw material. This article provides an overview of the development of diversified deep-processing of sugarcane, highlighting research advancements in the production of sugarcane wine, sugarcane vinegar, sugarcane cell water, rare sugars, and fructo oligosaccharides in China, particularly in Guangxi. The objective is to stimulate further innovation in the sugar industry, enhance the industry's value chain, and introduce advanced technologies to elevate the quality and efficiency of production. These efforts aim to achieve sustainable and healthy socio-economic development.

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TS-III-08

Unlocking agricultural potential: gamma radiation and natural polymers in climate change mitigation and crop fortification

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This research explores a groundbreaking approach to address climate change challenges and enhance crop sustainability using Gamma Irradiation to produce chitosan nanoparticles. These nanoparticles act as bio-friendly enhancers, boosting resistance to abiotic and biotic stresses, thereby improving sugarcane growth under changing climatic conditions while reducing resource inputs and enhancing overall sustainability. Multilocation trials conducted on two plant cane and one ratoon revealed significant improvements, with cane yields increasing by 23 t/ha and sugar yields by 4 t/ha. The cost-benefit ratio of 1:1.65 underscores the low-cost, eco-friendly nature of this plant growth promotion and stress tolerance strategy, highlighting its potential for value addition in managing seafood industry waste. Farmers in Maharashtra and neighboring states have widely adopted this nano-product across various crops, demonstrating productivity gains of 25-30%. This paper presents data on sustainable crop productivity in sugarcane and its intercrops, showcasing the novel application of radiation technology and biopolymers in agriculture. The fusion of nano-biotechnology and radiation technology underscores the importance of comprehensive risk assessment and collaborative efforts for successful innovation in agriculture. This approach opens new horizons for managing multiple stresses, optimizing nutrients, and enhancing agricultural productivity sustainably. However, challenges such as large-scale synthesis for commercialization and regulatory considerations need to be addressed for the widespread implementation of chitosan nanoparticles in modern sustainable agricultural systems.

TS-III-09

Biorefineries of lignocellulosic biomass into sustainable high-value biochemicals and functional materials

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In this presentation, Associate Professor Zhanying Zhang will summarize their achievements in developing multi-product biorefineries aimed at enhancing the value of sugarcane fibers. Sugarcane bagasse and trash, abundant agricultural biomasses, offer immense potential for sustainable fuel, chemical, and material production, crucial for global decarbonization efforts. Historically, converting sugarcane fibers into biofuels like bioethanol and biomethane has faced challenges due to high production costs and low product values. To overcome these hurdles, there is a growing interest in multi-product biorefineries. These facilities can process sugarcane fibers into a variety of high-value biochemicals and advanced functional materials, thereby improving the economic viability of the process. Associate Professor Zhang and his team at Queensland University of Technology have been pioneers in this field. Their initial research focused on developing efficient pretreatment technologies to produce fermentable sugars from sugarcane fibers. These sugars serve as the feedstock for microbial fermentation, which synthesizes biofuels and biochemicals. In recent years, their research has expanded to include biomass pretreatment and fractionation as a platform technology. This approach enables the production of advanced functional materials for diverse applications. For example, using alcohol organosolv pretreatments, the team has successfully produced lignin-containing cellulose nanofibrils. These nanofibrils exhibit tunable hydrophilicity/hydrophobicity and are suitable for use in polymer composites and Pickering emulsions. Furthermore, the group is exploring the production of responsive photonic materials based on cellulose nanocrystals derived from sugarcane fibers. Additionally, they have investigated converting lignin-rich residues into porous carbon materials tailored for supercapacitor applications. Most recently, their focus has shifted to converting lignin into hard carbon for potential use as a battery anode material. The will highlight the significant contributions to advancing multi-product biorefineries. Their work not only aims to enhance the value of sugarcane fibers but also underscores the potential of these biomasses in contributing to sustainable development goals through innovative and high-value product applications.

TS-III-10

Decarbonization in sugar industrial complex: possibilities and its challenges

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India holds the position as the world's third-largest purchasing power nation. It is the first highly populated nation and its power requirement is increasing manifold. he power requirement is achieved through fossil and non-fossil fuel. India imports more than 80% crude from OPEC countries and balance power is achieved with indigenous fuel mostly with Renewable fuel source. The surge in energy demand, driven by population growth and industrial development, has underscored the critical importance of renewable fuels such as ethanol and biodiesel. In response to global warming and increasing catastrophic natural events, there has been intensified policy discourse on carbon's role in climate change. Ethanol, a renewable fuel already available at low cost, presents a viable pathway for decarbonizing liquid fuels without the need for major technological advancements. India ranks as the world's third-largest producer of ethanol and has successfully implemented E20 ethanol-blended petrol, achieving an 11.2% blend rate by the year 2023-24. Ethanol production, largely sourced from sugarcane and grains like maize and damaged rice, has seen substantial growth facilitated by the government's initiatives to increase ethanol plants. This expansion not only supports the Ethanol Blended Programme but also contributes to decarbonization efforts, offering an alternative energy source amid rapid growth in the sugar sector. Under Indian leadership, initiatives like the Global Biofuel Alliance (GBA) have ensured global ethanol supply meets demand, contributing to reduced greenhouse gas emissions across road, air, and marine transportation sectors. Furthermore, efforts to introduce sustainable aviation fuel aim to foster a cleaner environment amidst rising global temperatures, which have exceeded 2°C, posing serious environmental challenges nationwide. In summary, India's proactive stance towards renewable fuels like ethanol reflects its commitment to mitigating climate change impacts and achieving sustainable energy security. The nation continues to prioritize decarbonization efforts through innovative energy policies and international collaborations aimed at fostering a cleaner and more sustainable future.

TS-III-11

Assessment of air pollution as influenced by *in situ* sugarcane trash burning

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An investigation was undertaken to assess the quality of ambient air (GHG's emission) as influenced by *in situ* sugarcane trash burning at village Padegaon, Dist. Satara, Maharashtra, India at 15 selected sites of recently harvested sugarcane plots (var. CoM 0265). The ambient air quality before and during *in situ* sugarcane trash burning was monitored. The green house gas emission (ambient air quality) *viz.,* $PM_{2.5\mu}$, $PM_{10\mu,}$ CO_2, NO_2, SO_2, CO, CH_4 and total VOC's concentrations were significantly increased to 59.94 µg M^{-3}, 268.53 µg M^{-3}, 545.27 ppm, 47.03 µg M^{-3}, 26.37 µg M^{-3}, 5.45 ppm, CH_4, 0.5 ppm, total VOC's 1.09 ppm, respectively with reduction in ambient O_2 level (19.35 %) due to trash burning. Further, the *in situ* sugarcane trash burning significantly increased green house gas emission of $PM_{2.5\mu}$ by 3.5 times, $PM_{10\mu,}$ by 4 times CO_2 by 2 times, NO_2 by 6 times, SO_2 by 1.5 times, CO by 1.5 times, CH_4 by 2.5 times and total VOC's by 2 times with reduction in air O_2 by 1.5 times over baseline ambient air quality. The effect of *in situ* sugarcane trash burning on periodical temperature of flame at soil surface indicated that the highest mean temperature was raised to 797.7 ^oC immediately after 1.15 minutes from start of *in situ* burning. The temperature of flame remained about 106.89 ^oC up to 5.30 minutes. The *in situ* burning of sugarcane trash required maximum about 13.30 minutes period for complete burning of *in situ* sugarcane trash. In conclusion, the significant losses of nutrients present in sugarcane trash, the significant increase in air pollution of green house gases *viz.,* $PM_{2.5\mu}$, $PM_{10\mu,}$ CO_2, NO_2, SO_2, CO, CH_4 and total VOC's with reduction in O_2 level in ambient air was observed due to *in situ* sugarcane trash burning.

TS-III-12

Sweet sorghum an indispensable crop for bioethanol production

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Prevailing energy crisis, urge the country to reduce Nation's dependence on imported oil. Fuel ethanol produced by converting fermentable sugars or starch into alcohol is being used as gasoline extender and octane enhancer. Different agencies of the Indian government have made rapid moves to put in place a favourable regulatory and retail ecosystem for safe and effective use of ethanol blended petrol and approved interest subvention incentives to promote new ethanol distilleries. Sugarcane molasses and grains alone cannot ensure to meet the increasing demand of ethanol production. Also owing to the reasons of food security issues rising by diverting food grains for ethanol production, critical issues of sugarcane cultivation like high water consumption, and eratic monsoon, the optimum ethanol production is becoming more challengeable. Hence there is a sense of urgency to offer alternative feedstock to meet the needs. Sweet sorghum(*Sorghum bicolor* L. Moench), a widely adapted sugar crop with high potential for bioenergy and ethanol production and which produces higher biomass yield with less inputs is listed as a candidate crop for biofuel production. Sweet sorghum is an attractive crop for biofuel production and in the era of climate change, it is good renewable feedstock suitable for cultivation under arid regions. This crop can be considered as a potential crop for ethanol production in northern India as it is a warm-season crop that needs high temperatures and short days and can also fit into the sugarcane based cropping systems. It tolerates drought and high-temperature stress better than many other crops. The promising five sweet sorghum genotypes developed by ICAR-IIMR, Hyderabad are being tested for their suitability to sub-tropical conditions at the NSI to establish a sustainable cropping system and studied for its competency in ethanol production. On an average 50t/ha stalk yield was obtained by all the five varieties cultivated. Maximum ethanol yield of 53.05 L/T and 2837 L/ha was obtained in the trials conducted. The extensive ecological adaptability shown by Sweet sorghum makes the industries economy viable. Thus sweet sorghum can be promoted to grow in all ecologies for setting up of sweet sorghum based distilleries to support nation's energy security.

TS-III-13

Consequence of ethanol blending in diesel engine: A strategic analysis of performance and emission

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In India, ethanol is produced from sugarcane juice, Syrup, BH and C molasses. Derived from solar energy-harnessing plants, ethanol is a sustainable and renewable fuel source, offering an eco-friendly alternative to traditional regular fossil fuels. This preaches in line with India's global move towards lowering carbon footprints. India also plans to have 20% ethanol in fuel by 2025 to cut vehicle pollution and reduce imports of fossil fuels to help the world's third-biggest emitter of greenhouse gases to reach its net-zero carbon goal by 2070.

This study investigates the effects of diesel-ethanol dual-fuel on combustion, engine performance, and emission attributes in a twin-cylinder common rail direct injection (CRDI) diesel engine at various engine loads and injector openings.

The study involves testing different amounts of ethanol in a twin-cylinder CRDI engine under various conditions. Conventional diesel engines have been modified into dual-fuel engines. The study compares performance factors such as power output, pressure, and efficiency between ethanol and diesel fuel. Additionally, it examines the impact of ethanol on engine combustion, including cylinder pressure and heat release rates, to determine its compatibility with the diesel engine. The study also analyzes emissions such as nitrogen oxides (NOx), carbon monoxide (CO), and hydrocarbons (HC) to assess the environmental impact of using ethanol.

Experiments are conducted at 2000 and 2400 RPM, under different loads (10, 20, 30, and 40 Nm) and injection openings (0%, 20%, 40%, and 60%), to assess how ethanol affects engine performance thoroughly. The highest ethanol content mixed with diesel reached upto 20% under a 40 Nm load.

TS-III-14

Improve the recovery and quality of sugar by controlling microbial contamination at field and process

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The financial sustain of Seasonal based sugar industry highly depends on its operational efficiency, sugar cane availability, duration of operation days and technology adopted. It is general practice of sugar industry to calculate total loss by addition of sugar in bagasse, sugar in filter cake, sugar in molasses and sugar loss as unknown. Similarly, sugar in cane determined by the summation of sugar in mixed juice and sugar in bagasse, the technocrats are never estimated sugar loss during cut to crush duration and at mill house due to microbial contamination. The composition sugar cane juice is very favorable for microbial metabolism and propagation. The exposed area of harvested cane is pathway for microbial invader. This activity impact quick loss of sucrose content in sugarcane from the time harvest and also has a significant effect on sugar recovery and quality. The opinion of many scholars is that the recovery loss due to enzymatic and microbial interference is varied from 0.3 to 1.2% on cane depends on local climatic condition. It is observed by authors that proper precaution and preventive measures is reduced sugar loss up to 60 % of sugar loss by microbial activity and also improve the quality sugar, ultimately financial gain to sugar mills.

TS-III-15

Bio-based sustainable economy : A transformative possibility

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This study explains the transformation and positive impact on the Indian socio-economic system that happens by effective and efficient utilization of agricultural non-food biomass. India is one of the largest producers of food grains & crops and around 800 MMT non-food biomass is presently available for value addition. This non-food biomass can be a game changer as it can replace the existing fossil fuel based raw material and transform the entire value chain of biomass with highest conversion efficiency and enhances profitability. It results not only in sustainable agriculture model but also holistic circular economy having very low carbon footprint. Also, different value-added products like compressed biogas (CBG), green chemicals, bio-degradable polymers, bio-ethanol & sustainable aviation fuel etc. are produced from the available non-food biomass. After extraction of carbon from biomass, the nutrients can be recycled back to the farms.The author has designed and developed the thermal heat recycling technology based on mechanical vapour recompression (MVR) system at very low temperature to eliminate the burning of biomass and other fuel for processing agricultural produce like sugarcane, beverages etc.This is a transformational shift in the industrial landscape where in the entire process becomes carbon negative and water positive. This is a decentralised technology, and it can be set up at grassroot level or village level.The consumption and production happen locally eliminating the need of transportation to the long distance.It increases the income of the farmers and addresses migration issues effectively as employment are created locally.As the sugarcane is grown across the country and is one of the most effective converters of sun light to biomass, it ranks as one of the highest per unit area biomass producing crop in totality. Recently setup sugarcane processing units based on this technology, there is no boiler in the units and therefore no burning of biomass in the process resulting in zero pollution and no CO_2 emissions. These units are situated in the middle of field at village level, eliminating the transportation cost and associated CO_2 emissions. 100% of the bagasse i.e. biomass after sugar cane milling is saved.The complex is water positive, and no external source of water is used. The water from the sugarcane is used for the irrigating the nearby fields. The author firmly believes that this transformation in the agriculture and biomass landscape will have a multiplier effect on our economy and society as a whole. This decentralised system of efficient conversion of biomass at farms level will result in employment creation, production of green energy, increasing income of farmers and achieving the net Zero Targets much earlier.

TS-III-16

Hybrid bagasse dryer technology – integration of waste heat recovery and flue gas cleaning

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The hot flue gases from the boilers were being emitted to the atmosphere since ages. The concept adopted is to utilize waste heat from the flue gases for fuel drying. Firstly, the Flash Dryer was conceptualized purely to utilize waste heat to dry the high moisture fuel. On the test bed installation, when we measured particulate emissions after the Dryer to have a check for any loss of fuel, we were pleasantly surprised to find substantial reduction in the particulate emissions from the flue gas. This discovery led to the conceptualization of Hybrid Model. The Hybrid model replaces the conventional "air pollution control device" on sugar mill boilers by using fibrous and wet mill bagasse as scrubbing media while drying and uses compact Wet Electrostatic Precipitator (WESP) as an integral part to clean flue gases to the extent of even below 10 mg/Nm^3. The first full scale unit of Hybrid Dryer was installed in 2019 in a reputed sugar mill in India, Daurala Sugar Works, on a new 90 TPH High Pressure Boiler and the same is running successfully achieving moisture reduction in bagasse from 50% to 39% while meeting the targeted particulate emission of below 50 mg/Nm^3 consistently. This had resulted in reduction of specific fuel consumption by 8% to 10% through increased thermal efficiency of boiler, thereby generating revenue on a sustained basis. The Hybrid model has a potential to make "air pollution control" a revenue generating model for the sugar industry across globe proving legitimacy of its tag line "***Gaining while Greening***" in true sense.

TS-III-17

Compressed biogas (CBG) a revolutionary biofuel: A case study

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In India there is a huge potential to produce Biogas from various degradable Bio feed stocksviz, Surplus agricultural residue, Surplus Bagasse, Sugarcane pressmud, sugarcane spentwash, Municipal solid waste, Cow dung/animal waste etc. This biogas can be converted into Compressed Biogas (CBG) for value addition. India has the potential to produce 3.15 MMT CBG per anum. India's Natural Gas sector, projecting a8.5% Year-on-year consumption growth in 2024. About 46.1% of the compressed Natural gas (CNG) used in India is presently imported. So as to reduce the India'simport bill of LNG, Compressed Biogas is a major alternative source. According to International Energy Agency (IEA)'sreport analysts, bioenergy is projected to account for 18% of the total energy supply in 2050. The government of India announced a phased mandatory blending of Compressed Bio-Gas (CBG) in Compressed Natural Gas (CNG) and Piped Natural Gas (PNG) segments of the City Gas Distribution (CGD) sector in October 2023. CBG Blending Obligation (CBO) will promote production and consumption of Compressed Bio-Gas in the country.Five percent blending of biogas with natural gas will reduce LNG import by USD 1.17 billion. The CBO will be voluntary till FY25 and mandatory blending obligation would start from FY26.CBO shall be kept as 1%, 3% and 4% of total CNG/PNG consumption for FY26, 2026- 27 and 2027-28 respectively.From 2028-29 onwards CBG Blending Obligation will be 5%. The availability of CBG will reduce the dependency on fossil-fuel, which will help to lower down the greenhouse gas (GHG) Emission. It is a cost-effective fuel as compared to fossil fuels enhancing vehicle efficiency and providing value addition in come.It also ensures effective waste management. Looking to the numerous benefits of production of CBG Government of India provides assistance for setting up of plants for generation ofCBG and for procuring biomass aggregation machinery. The Government of India had launched an ambitions green Biofuel program 2018. In this program first priority is given for ethanol, second priority for CBG and third is for green Hydrogen. The Biogas is being produced since long days by farmers from cow dung, from city corporation bio waste, sevage and molasses distilleries of sugar industry. The gas was either burnt for a domestic purpose for cooking or burnt in boilers for heat or steam generation. The methane content of the gas is about 55 to 58% accomplished with other main impurities like H2S, CO2 and other etc. The quantity of methane vary according to different feed stock the methane content in biogas is upgraded by removing sulfur and carbon dioxide to get methane content from 90% to 98% in the purified biogas. It is further compressed upto 250 bar and filled in cascades called CBG (compressed biogas). We at our ShreenathMhaskobaSakharKarkhana Limited installed 10 TPD CBG plant and commissioned successfully during season 2023 - 24.The gas is delivered to retail outlets and also injected into CNG pipeline.

TS-III-18

Sugar industry revamp with competitive and modern concepts

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The increased cane prices, high labour cost and low sugar prices are making it difficult for the sugar industry to remain profitable. The challenges are growing day by day to get sufficient cane to the sugar factory, processing it at lowest possible cost and achieve maximum recovery in order to be competitive in the market. Under the tough market conditions, the sustainability of existing low performance plants is under question. Many of the sugar factories still work at a process steam demand between 40 – 60% on cane, power export less than 90 kWh/ t cane and overall sugar recovery between less than 85%. Whereas many sugar factories in India, Pakistan and Brazil are already operating between 26 to 32% steam on cane with more than 100 kWh/t cane power export and high sugar recovery.

The important characterises of the competitive plants are minimum process steam requirement, Optimized electric demand, Maximum power export, Maximum over all sugar recovery, Minimum manpower requirement, Minimum maintenance cost and Operational flexibility

To make the plant efficient and competitive, modern technologies are playing an important role. Several modern technologies and concepts are available in the market to enhance the plant performance, but a careful approach is required to select such technologies and concepts. This paper provides an overview about the benchmarking of performance parameters, modern design tools, adaptation of the modern technologies and background information on the modern technologies.

TS-III-19

Integrated approach for treatment of molasses based distillery spent wash

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Spent Wash, a dark brown coloured eûuent emanating from typical molasses-based distillery has always been challenge to handle, treat and dispose. Over a period of time the treatment methodologies, technologies, disposal techniques have been upgraded to meet the stringent pollution control norms set up by regulatory authorities. **ZERO LIQUID DISCHARGE (ZLD)** has been the latest treatment practise being followed for treatment and handling of the distillery spent wash. Spent wash from typical molasses-based distillery has classified as highly polluting hazardous eûuent. This is mainly due very high concentration of organic matter resulting into very high values of BOD and COD. Significant concentration of refractory COD and intense colour due to caramelised sugar. In the early days the spent wash was just applied on the land for ferti-irrigation. This was followed by lagoon technology where in huge lagoons of more than 50 days storage capacity were used for uncontrolled anaerobic / facultative treatment of the spent wash followed by its disposal on land or water. These unscientific techniques resulted destroying fertility of land and spoiling of ground as well as surface water. With increasing need of energy / fuel and realising the biogas generation of spent wash due to high concentration of biodegradale organic matter in early 1980s. Anaerobic treatment for the spent wash started becoming popular. Various types of anaerobic reactors such as Bulk Volume Fermentation, Fixed Film Reactor, Completely Stirred Reactor, etc were developed by technology suppliers. These anaerobic reactors were able to remove significant amount of Organic matter and generate good amount of biogas with attractive payback period. However, the post anaerobic spent wash still has significant concentration of organic matter and intense colour discouraging its disposal on land or in water body. Second stage treatment in the form of energy intensive two stage aeration was tried as an intermediate solution for few years. However, high concentration of TDS, refractory cod and colour was still a challenge. Composting of raw spent wash / post anaerobic spent wash was also tried for some period but huge land requirement / press mud requirement and operating problems in monsoon could not make it full proof solution. With improved and efficient evaporation techniques in multiple eûect evaporators, concentration of raw spent wash / post anaerobic spent wash is gaining popularity. Concentration of raw spent wash followed by its incineration in slope fired boiler is being very commonly used now a days. However, challenges such as high capital cost of boiler, loss of revenue due to no recovery of biogas, shutdown due to high cleaning frequency are still exists. anaerobic treatment of spent wash with good amount of energy recovery followed evaporation and concentration of the post anaerobic spent wash in MEE and using the concentrate for composting in captive distillery or in dryer can be highly cost eûective in terms of capital and operating cost. The condensate generated in evaporation and dryer can be treated in condensate polishing unit and recycled back in distillery unit for molasses dilution and cooling towers.

8th IAPSIT International Sugar Conference ISC-2024
Quy Nhon, Vietnam

Awards and Honours

IS-2024
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Awards and Honours

Life Time Achievement Awards for Leadership and Excellence

Mr. Le Van Tam
Ex-Chairman, Lam Son Sugar Joint Stock Corporation, Vietnam
for Leadership & Excellence: Community Service & Sustainable Development of Sugar Industry

Prof. Jean Trần Thanh Vân
President of Rencontres du Vietnam, International Centre for Interdisciplinary Science and Education,Vietnam for Leadership and Excellence: Promotion of Science & Technology in South East Asia

Mr. Shivajirao C. Deshmukh
Advisor and Ex-Director General
Vasantdada Sugar Institute, Pune, India
for Leadership & Excellence in Sugarcane R & D

Prof. Yang Rui Li
Director & Professor, Sugarcane Research Institute,
Guangxi Academy of Agricultural Sciences, Nanning, PR China
for Leadership & Excellence in Sugarcane Research and Capacity Building

Mr. K.V.S.R. Subbaiah
General Director, KCP -Vietnam Industries Limited
Son Hoa District, Phu Yen Province, Vietnam
for Leadership and Excellence : Farmers Welfare & Modernization of Sugar Mills

Mr. Nguyen Van Loc
President, Vietnam Sugarcane and Sugar Association (VSSA)
for Farmers Empowerment and Development of Sugar Industry in ASEAN & Vietnam

Sugar Industry Execellence/Life Time Achievement Awards - 2024

Mr. Sanjay Awasthi
President, Sugar Technologists Association of India &
Chief Executive, ISGEC Heavy Engineering Ltd, Noida, India
for his outstanding contribution to Innovations in Sugar Industry.

Prof. Narendra Mohan
Ex-Director, National Sugar Institute, Kanpur, Uttar Pradesh, India
for his outstanding contribution in the field of Promotion & Diversification
in Sugar Industry

Dr. Shaochun Ma
Professor, College of Engineering, China Agricultural University, Haidian,
Beijing, PR China for his outstanding contribution to Mechanisation
in Sugar Industry

Dr. Sushma Sood
USDA-ARS, Sugarcane Field Station, Canal Point, Florida, USA
for her outstanding contribution to Sugarcane Research & Industry

Mr. Sambhaji Kadu Patil (Retd. IAS)
Director General, Vasantdada Sugar Institute, Manjari, Pune, India
for his outstanding leadership in Sugar Industry Research

Mr. Vivek Verma
Managing Director, Spray Engineering Devices Ltd., Mohali, Punjab
for his outstanding contribution in Innovations in Energy Efficiency.

Ms. Reshmi Kumari
Director, Planning, Policy & Research, Ministry of Sugar Industry,
Govt. of Fiji, Fiji for her outstanding contribution to Human Resource
Development and Capacity Building in Sugar Industry .

Dr. S.P. Singh
Project Co-ordinator, ICAR-Central Institute of Agricultural Engineering
Bhopal, M.P., India for his outstanding contribution in
Agricultural Mechanization and Technology Transfer

Sugar Industry Execellence/Life Time Achievement Awards - 2024

Dr. S. Alarmelu
Principal Scientist, Genetics & Plant Breeding, Division of Crop Improvement ICAR-Sugarcane Breeding Institute, Coimbatore, India for her outstanding contribution in Sugarcane Improvement and Variety Development

Dr. T. Rajula Shanthy
Principal Scientist, Agricultural Extension, ICAR-Sugarcane Breeding Institute, Coimbatore, India for her outstanding contribution in Rural Women Empowerment & Entrepreneurship

Mr. Ashok Kumar Nanda
President, Spray Engineering Devices Limited, Mohali, Punjab, India
for his outstanding contribution in the field of Sugar Processing Technology

Mr. P.K. Belsare
Managing Director, Indiana Sucro-Tech (Pune) Pvt. Ltd.,
Vetal Baba Chowk, Senapati Bapat Road, Pune for his outstanding contribution in the field of Innovation in Sugar Processing Technology

Dr. R. Manimekalai
Principal Scientist, Biotechnology, ICAR-Sugarcane Breeding Institute, Coimbatore, TN, India for her outstanding research contribution in Sugarcane Improvement Programme

Natural Resource Biochem Pvt. Ltd.
3rd Floor Pratap Market, Cinema Rd, Gorakhpur, Uttar Pradesh
for its outstanding contribution in Product Development

Sugar Cane Growers Council
Lautoka, Fiji for its outstanding contribution in
Empowering Sugarcane Farmers & Industry

Mr. N. Chinnappan
President, The South Indian Sugarcane & Sugar Technologists' Association (SISSTA), Executive Director Dhanalakshmi Srinivasan Sugars Pvt Ltd. Tamilnadu, India
for his outstanding contribution in the field of Promotion and Diversification in Sugar Industries

IAPSIT - SSRP Life Time Achievement Award

Ms. Maria Regina B. Martin
Philippine Sugar Research Institute Foundation, Inc. , PHILSURIN, Philippines for her outstanding contribution in the field of Sustainable Development of Sugarcane Industry

Dr. Prakash Lakshmanan
Professor & Director, Sugarcane Research Institute, Guangxi Academy of Agricultural Sciences, Nanning, Guangxi, PR China for his outstanding contribution in the field of Sugarcane Improvement & Production Technologies

Mr. Nitin Deshpande
Trio-chem Sucrotech Engineering and Projects Pvt. Ltd., Pune, Maharashtra India for his outstanding contribution in the field of Promotion of Green Technologies

Dr. Wirat Vanichsriratana
Associate Professor, Kasetsart University, Biotechnology, Bangkok, Thailand for his outstanding contribution in the field of Product Development and Innovation

Mr. M. Silvester Goldwin
Whole Time Director, Kothari Sugars and Chemicals Ltd. Chennai, TN, India for his outstanding contribution in the field of Innovation & Sustainable Development of Sugar Industry

Prof. R.V. Dani
Technical Advisor & Head, Sugar Technology Department Vasantdada Sugar Institute, Manjari, Pune, India for his outstanding contribution in the field of Excellence in R & D work for Sugar Industry

Dr. Tang Qizhan
Professor, Division of International Cooperation, Guangxi Academy of Agricultural Sciences, No. 174, East Daxue Road, Nanning, Guangxi, P.R. China for his outstanding contribution in the field of Human Resources & Development

Prof. Umesh K. Patil
Head, Deptt. of Pharmaceutical Sciences, Dr. H.S. Gour Vishwavidyalaya, Sagar, Madhya Pradesh, India for his outstanding contribution in the field of Sugarcane Phytopharmaceuticals

SSRP Fellow Award - 2024

Dr. Dong-Liang Huang
Sugarcane Research Institute, Guangxi Academy of Agricultural Sciences Nanning, Guangxi, China for his Outstanding Contribution to Sugarcane Crop Improvement

Dr. P. Murali
Principal Scientist (Ag. Economics), Head, Stat. & Economics Section, Sugarcane Breeding Institute, Coimbatore, Tamil Nadu, India for his Outstanding Contribution to Sugarcane Crop Improvement & Diversification

Dr. V.P. Sobhakumari
Genetics & Cytogenetics, ICAR-Sugarcane Breeding Institute, Coimbatore Tamil Nadu, India for her Outstanding Contributions to Sugarcane Crop Improvement

Dr. C. Appunu
Division of Crop Improvement, Sugarcane Breeding Institute Coimbatore, India for his Outstanding Contribution to Sugarcane Crop Protection

Dr. Krishan K. Verma
Senior Researcher/ Foreign Expert, Sugarcane Research Institute Guangxi Academy of Agricultural Sciences, Nanning, Guangxi, China for his Outstanding Contribution to Sugarcane Crop Production

Dr. A.K. Tripathi
Associate Professor, Agronomy, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India for his Outstanding Contribution in Crop Production

Progressive Sugarcane Grower's Award

Shri Ram Raja Niranjan
Director
Betwa Seed Corporation, Jalaun, UP, India

Shri Kaushal Kumar Mishra
Shahjahanpur, Uttar Pradesh
for his outstanding contribution in Sugarcane Production through Application of Improved Agri-technologies.

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- Patcharin Songsri, Khon Kaen — Thailand
- Nattapat Khumla, Nakhon Sawan — Thailand
- Fernando Munoz, CENICANA — Colombia
- Nawshad Joomun, MSIRI, Reduit — Mauritius
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- P. Murali, SBI, Coimbatore — India
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8th IAPSIT International Sugar Conference ISC-2024
Quy Nhon, Vietnam

Technical Programme

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8th IAPSIT International Sugar Conference & Sugarcon-2024
September 15-19, 2024
Venue: ICISE, Quy Nhon, Vietnam
Technical Program

Time	Activity	Venue
Sunday, September 15, 2024		
Arrival of Guests in Quy Nhon		
16:00-19:00 pm	Registration Desk Open	Seagull Hotel
19.00-21.00 pm	Welcome Dinner	Seagull Hotel
Day I **Monday, September 16, 2024**		
8:00-8:45	Transfer of Delegates from Anya & Seagull hotels to ICISE by Bus	
8:45 -9.25	Registration Desk Open	ICISE Centre Reception Desk
9:25-11:00	Inaugural Session of ISC-2024 & Sugar Exhibition	ICISE Main Hall
9.25-9.30	Invitation of guests to dais	ICISE Main Hall
9.30-9.40	Honours Guests	
09.40-09.45	Welcome addcress by the President IAPSIT: Prof. (Dr.) Yang Rui Li	
09.45-09.50	Welcome of Guests by the Organizing Secretary-ISC 2024: Dr. Govind P. Rao	
09.50-09.55	Address by the President ICISE, Vietnam: Prof. Jean Tran Thanh Van	
09.55-10.00	Setting the Scene IS-2024: Dr. S. Solomon, President, SSRP	
10.00-10.05	Address by the President STAI : Mr. Sanjay Awasthi	
10.05-10.15	SSRP: 25 Years of Glorious Service to Sugar Industry: Video Show	
10.15-10.25	Release of Souvenir, Special Silver Jubilee Issue of Sugar Tech and Books by Chief Guests	
10.25-10.45	Award Presentation to Industry/Scientists/Farmers by Chief Guest and other dignitaries on dais	
10.45-10.55	Address by Chief Guest	
10.55-11.00	Vote of Thanks , Dr. Tran Thanh Son, Vice Director, ICISE	
11:00-11:10	Photo Session	
11:11-12.00	Visit of Exhibition and Tea break	

Plenary Lectures		
12.00-12.30	**PL-1** : Dr. Prakash Lakshmanan, Director, Sugarcane Research Institute, Nanning, PRC *Breaking sugarcane productivity plateau in ASEAN region under changing climate scenario: Are we heading in the right direction?*	ICISE Main Hall
12.30-13.00	**PL-2:** Prof. Narendra Mohan, Ex-Director, National Sugar Institute, Kanpur, India *Sugarcane Industry: A possible bio-energy hub*	ICISE Main Hall
13:00-14.00	**Lunch**	ICISE Area
14.00-14.20	**PL-3:** Dr. Maria Regina Martin, Director General, PHILSURIN, Philippine *Research and development priorities for sustainable growth of Philippine sugar industry*	ICISE Main Hall
14.20-14.40	**PL-4:** Mr. Sanjay Awasthi, President, The Sugar Technologists Association of India *Sustainability of sugar business: Efficiency and diversification*	ICISE Main Hall
14.40-15.00	**PL-5:** Mr. Nguyen Van Loc, President, Vietnam Sugarcane and Sugar Association (VSSA) *Role of Vietnam Sugarcane and Sugar Association on the sustainable development of sugar industry in Vietnam*	ICISE Main hall
15.00-15.20	**PL-6:** Mr. Arvind Chudasama, Sugar International, Germany *Diversification opportunities for sugar companies amidst maturing bioeconomy*	ICISE Main hall
15.20-15.35	**Tea Break**	ICISE Main hall
15.35-15.50	**PL-7:** Dr S.N.Sushil, Director, ICAR-NBAIR, Bengaluru, India *Safeguarding Sugarcane Cultivation from Insect Pests through Biocontrol and other Compatible Technologies in ASEAN Countries vis-à-vis India*	ICISE Main hall
15.51-16.05	**PL-8** : Dr. G. Hemaprabha, Ex Director, Sugarcane Breeding Institute, Coimbatore, India *Modern Sugarcane varietal improvement – Indian perspective*	ICISE Main hall

16.06-16.35	**Presentation by Sugar / Bio-energy Industry Technology Providers** **(Diamond/Gold Sponsors) (10 min each)** 1. Natural Resource Biochem Pvt. Ltd., Gorakhpur Uttar Pradesh 2. Saisidha Sugar Equipments & Eng. Co. Pvt. Ltd. Pune, India 3. Fives Cail-KCP Limited , Chennai, India	ICISE Main hall
16.36-16.50	**PL9:** Dr. Cao Anh Duong, DG, Sugarcane Research Institute, Vietnam *R&D imperatives for the Vietnam sugar industry in the integration period into ASEAN sugar sector.*	ICISE Main hall
16.51-17.05	**PL10**: Dr. R Vishwanathan, Director, Indian Institute of Sugarcane Research, Lucknow, India *Green technologies to manage sugarcane diseases in Asian countries*	ICISE Main hall
17.06--17.20	**PL11:** Dr. Wirat Vanichsriratana, President TSSCT, Thailand *Current Trends and Transitions in Thai Sugarcane Production: From Burnt Cane to Green Cane*	ICISE Main hall
18:30-21:00	**Gala Dinner**	**ICISE Lawns**
21:00 onwards	Back to hotels (Bus will be available at ICISE Centre for hotel transfers)	

Day II

Tuesday, September 17, 2024

Theme Presentation

(Venue : Main Hall, Ground Floor)

Chairman : **Mr. Shivajirao C. Deshmukh, Advisor, VSI, Pune**

Co-Chairman : **Dr. Dong Liang Huang, Nanning, China**

Coordinator 1 : **Dr. R. Gomathi, SBI, Coimbatore, India**

Coordinator 2 : **Dr. Geetha Nandgopal, SRI, Fiji**

08.30-09.00		**Bus transfer from Hotel to ICISE**	
09.00-09.15	TH-01	Development of Sugar Industry in China: R & D Priorities for Sustainable Sugarcane Production	Yang-Rui Li Sugarcane Research Institute, Guangxi Acad. Agricul. Sci., Nanning, China

09.16-09.30	TH-02	Mechanization and Sugarcane Production in Fiji	Reshmi Kumari, Director Ministry of Sugar Industry, Fiji
09.31-09.45	TH-03	Advance to the next level of molecular breeding in Canal Point, Florida	Md S Islam Sugarcane Field Station, USDA, Canal Point, Florida
9.45-10.00	TH-04	Genome editing for the sustainable improvement of Sugarcane	R. Manimekalai ICAR-SBI, Coimbatore, India
10.01-10.15	TH-05	Research and development prospects for sugarcane industry in Vietnam	Son Chu-Ky Hanoi University of Science and, Vietnam
10.15 - 11.15am		**Visit of Exhibition & Tea Break**	**Exhibition Area**

Technical Session I

Sugarcane Production, Diversification and Mechanization

Tuesday, September 17, 2024

(Venue : Main Hall, Ground Floor)

Chairperson : **Ms. Maria Regina B. Martin, PHISURIN, Philippine**
Co-Chairman : **Dr. D.H.Phalke, College of Agriculture, Pune, India**
Coordinator 1 : **Dr. S.S. Nooli, ARS, Samkeshwar, India**
Coordinator 2 : **Dr. Krishan K Verma, GXAAS, Nanning, PRC**

Technical Session I (Forenoon)			
11.16-11.30	TS-I-01 (Lead)	Tech-Innovations for resilient sugarcane production systems	B Sundara Sugarcane Breeding Institute, Coimbatore, India
11.31-11.45	TS-I-02 (Lead)	Continuous emergence of new variants in sugarcane red rot pathogen *Colletotrichum falcatum*: who wins, the host or the fungus?	R. Viswanathan Indian Institute of Sugarcane Research, Lucknow ,India

11.46-12.00	TS-I-03 (Lead)	Enhancing productivity and economic security through sugarcane based cropping system	A.K. Singh, Director, Sugarcane Research Institute Dr. RP Central Agricultural University, Pusa-,India
12.01-12.15	TS-I-04 (Lead)	The disease resistance of the sugarcane cultivars released in the past two decades in Florida	Sushma Sood USDA-ARS, Sugarcane Field Station, Canal Point, Florida
12.15-12.25	TS-I-05	Foot-operated sett cutter for sugarcane farmers	S.P. Singh, Project Co-ordinator, ICAR-Central Institute of Agricultural Engineering, Bhopal, India
12.26-12.35	TS-I-06	Geostatistical modelling for spatial variability assessment of soil fertility in sugarcane growing soils of Jalna District, Maharashtra, India	Preeti Deshmukh Vasantdada Sugar Institute, Pune
12.36-12.45	TS-I-07	Recent Advances and Perspectives of Sugarcane Mechanization in India	K N Agrawal ICAR-Central Institute of Agricultural Engineering, Bhopal, India
12.46-12.55	TS-I-08	Efficient water management through micro irrigation systems in sugarcane	P. P. Shinde Vasantdada Sugar Institute, Pune, India
13.00-14.00	**LUNCH**		
Technical Session I (Afternoon)			
Chairman :	**Dr. Prakash Lakshmanan, Director, Sugarcane Research Institute, Nanning, PR China**		
Co-Chairman :	**Dr. Anil Kumar Singh, Director, RAU, Samstipur, Bihar, India**		
Coordinator 1 :	**Dr. Shaochun Ma, China Agricultural University, Beijing, China**		
Coordinator 2 :	**Dr. P.P. Shinde, VSI, Pune, India**		
14.01-14.10	TS-I-09	Asian subterranean termite (*Coptotermus gestroi* (Wasmann)) infestation in Sugarcane in Fiji: Current status	N. Geetha Sugar Research Institute of Fiji, Fiji Islands

14.11-14.20	TS-I-10	Fiji leaf gall disease: A relook on prevalence and impact on sugarcane production in Fiji	N. Geetha Sugar Research Institute of Fiji, Fiji Islands
14.21-14.30	TS-I-11	Influence of in situ sugarcane trash burning on physico-chemical properties of soil	D.H. Phalke College of Agriculture, Pune
14.31-14.40	TS-I-12	Effect of long term integrated nutrient management on growth, cane yield and quality of pre-seasonal ratoon sugarcane in vertisol	D.H.Phalke College of Agriculture, Pune
14.41-14.50	TS-I-13	Novel nuancesin exploiting endophytic entomopathogenic fungi: An agro-ecosystems friendly approach for sugarcane pest management	V. Ambethgar Tamil Nadu Agricultural University Tiruchirappalli, Tamil Nadu, India
14.51-15.00	TS-I-14	The influence of fertigation on yield and ratooning ability of sugarcane	Thitiporn Machikowa Suranaree University of Technology, Nakhon Ratchasima Thailand
15.01-15.10	TS-I-15	Mechanized priming of planting material for sustainable sugarcane agriculture	P. Malathi ICAR-SBI, Coimbatore, Tamil Nadu, India
15.11-15.20	TS-I-16	Economizing water use in sugarcane cultivation in tropical India	P. Geetha ICAR-SBI, Coimbatore, Tamil Nadu, India
15.21-15.30	TS-I-17	Co-occurrence of crown mealy bug, *Phenacoccus saccharifolii* (Green) and Pokkah boeng disease, *Fusarium verticillioides* (Sacc.) Nirenbergon sugarcane in cauvery delta zone of Tamil Nadu, India	V. Ambethgar Tamil Nadu Agricultural University Tiruchirappalli, Tamil Nadu, India
15.31-15.35	TS-I-18 (Short)	Identification and evaluation of smut resistance in 20 GT sugarcane varieties	Liu Xihui Sugarcane Research Institute Guangxi Academy of Agricultural Sciences, Nanning, China

15.36-15.40	TS-I-19 (Short)	*Chilo tumidicostalis* Hampson: A destructive internal borer pest of sugarcane in Bihar	Anil Kumar Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Samastipur, Bihar, India
15.41-15.45	TS-I-20 (Short)	Field assessment of pink mealybug *Saccharicoccus sacchari* (Cockerell) populations on different sugarcane varieties in Fiji	N. Geetha Sugar Research Institute, Fiji Islands
15.46-15.50	TS-I-21 (Short)	Putative vectors of sugarcane grassy shoot and sugarcane white leaf-associated phytoplasma in eastern Uttar Pradesh, India	Kirti Rawat Indian Agricultural Research Institute, New Delhi, India
15.51-15.55	TS-I-22 (Short)	A case study of sub-surface drainage (SSD) project on saline soil reclamation and its effect on sugarcane production and productivity implemented by Shree Datta Shetakari Sahakari Sakhar Karkhana Ltd. Shirol (Kolhapur) Maharashtra	Santosh Dudhale Shree Datta Shetakari Sahakari Sakhar Karkhana Ltd. Shirol (Kolhapur) Maharashtra
15.56-16.00	TS-I-23 (Short)	Status and incidence of Fall Armyworm *Spodoptera frugiperda* (J.E. Smith) on corn in Tamil Nadu, India	V. Ambethgar Anbil Dharmalingam Agricultural College & Research Institute, Tiruchirappalli, India
16.00-16.45		**HIGH TEA AT SEA BEACH**	ICISE Sea Beach
16.46-16.50	TS-I-24 (Short)	Population dynamics of sorghum insect pestsin cauvery delta districts of Tamil Nadu in India	V. Ambethgar Anbil Dharmalingam Agricultural College & Research Institute, Tiruchirappalli, Tamil Nadu, India
16.51-16.55	TS-I-25 (Short)	Analysis of airflow and mixture movement characteristics in sugarcane harvester extractor based on CFD-DEM	Baocheng Zhou China Agricultural University, Beijing 100083, China

17.00-17.45		**TECHNOLOGY PROVIDER PRESENTATION (5 mins each)** 1. S.B. Reshellers Pvt. Ltd., Kolhapur, Maharasthra 2. PPI Pumps, Ahmedabad, Gujarat 3. Divine Tubes Pvt. Ltd., Gandhinagar, Gujarat 4. Puri Industries, Muzaffarnagar, Uttar Pradesh 5. Shrijee Process Enginering Works Ltd., Mumbai 6. India Sucro-TechPrivi Life Sciences Pvt. Ltd.,Mumbai 7. Suviron Equpments Pvt. Ltd., Ahmednagar, India 8. Spray Engineering Devices Ltd 9. Catalysts Biotechnologies Pvt. Led, Delhi.	
18.00 - 20.00		**DINNER** **Bus will be available at ICISE centre to City Hotel**	**Quy Nhon City**

Day II

Tuesday, September 17, 2024

Technical Session II

Sugarcane Improvement, Production Physiology and Biotechnology

(Venue : Hall 2, 1st Floor)

Chairperson : **Dr. G. Hemaprabha, Former Director, SBI, Coimbatore, India**

Co-Chairman : **Dr. Nattapat Khumla, Field Crop Research Center, Thailand**

Coordinator 1 : **Dr. Sudha D. Ghodke, VSI, Pune**

Coordinator 2 : **Dr. P. Geetha, SBI, Coimbatore, India**

11.16-11.30	TS-II-01 (Lead)	Climate resilient sugarcane: Adaptive mechanism of thermo-tolerance	Raju Gomathi Sugarcane Breeding Institute, Coimbatore, India.
11.31-11.45	TS-II-02 (Lead)	Assessment of drought tolerance of sugarcane (*Saccharum* spp) hybrids using physiological and yield traits	S. Alarmelu ICAR- Sugarcane Breeding Institute, Coimbatore, India
11.46-12.00	TS-II-03 (Lead)	Yield performance of NSUT13-154, a promising sugarcane clone suitable for mechanical harvesting	Nattapat Khumla Nakhon Sawan Field Crops Research Centre, Thailand

12.01-12.10	TS-II-04	Integrated differential gene expression, TWAS and WGCNA analyses of a F1 population transcriptome identified key genes associated with sucrose accumulation in sugarcane	Dong-Liang Huang*, Ao-Mei Li Guangxi Academy of Agricultural Sciences, Nanning, , China
12.11-12.20	TS-II-05	Activity of key enzymes and expression characteristics of related genes in nitrogen metabolism of sugarcane	Fen Liao Sugarcane Research Center, Chinese Academy of Agricultural Sciences, Nanning, China
12.21-12.30	TS-II-06	A gibberellin biosynthesis enzyme-encoding gene, ScGA20 oxidase1, can enhance sugarcane growth through its involvement in phytohormones and growth processes	Dong-Liang Huang Guangxi Academy of Agricultural Sciences, Nanning, , China
12.31-12.40	TS-II-07	The protein Crp mediates transcriptional regulation of carbon and nitrogen metabolism in nitrogen-fixing bacterium DX120E and sugarcane	Yang-Rui Li College of Agriculture, Guangxi University, Nanning, China
12.41-12.50	TS-II-08	Metabolic and molecular diversity of tropical and subtropical sugarcane varieties at tropical climate	R. Gomathi Sugarcane Breeding Institute, Coimbatore Tamil Nadu, India
12.51-13.00	TS-II-09	The potential use of *Bacillus subtilis* isolates as bioprotectant against sugarcane smut and growth-promoting agent in sugarcane seedling	Weerakorn Seangsai Khon Kaen Field Crops Research Center, Thailand
13.01-14.00		**LUNCH**	**AT ICISE**
14.01-14.10	TS-II-10	Biochemical and endogenous growth hormone changes during meristem tip culture of exotic and Indian clones of sugarcane	A. Suganya ICAR-Sugarcane Breeding Institute, CoimbatoreTamil Nadu, India

14.11-14.20	TS-II-11	Assessment of plant enzyme activities in sugarcane genotypes under sodic shrink-swell soil	A. V. Patil Soil Science and Agricultural Chemistry, Mahatma Phule Krishi Vidyapeeth, Rahuri College of Agriculture, Pune, India
14.21.14.30	TS-II-12	Comparative impact of changes in yield attributes on relative contribution to productivity of sugarcane	B.P. Patil DSTA, Pune , Maharashtra India
14.31.14.40	TS-II-13	Advancing nutrient economy and increasing sugarcane yield by application of consortium of beneficial soil microorganisms and consortium endophytic nitrogen fixing bacteria	Sudha D.Ghodke, Vasantdada Sugar Institute, Manjari (Bk), Pune-412307
14.41-14.50	TS-II-14	Green technology to improve early growth in sugarcane : Impact of naturally derived bio-stimulant DPV application under sub-tropical conditions	Harish Gangwar Vijasu Ecotec Pvt Ltd., Mumbai, India
14.51-15.00	TS-II-15	Enhancing resilience in agriculture through sugarcane based intercropping for improved crop yield	A.K. Tripathi Banda University of Agriculture and Technology, Banda-India
15.01-15.10	TS-II-16	Effect of water stress on growth and yield for Different Sugarcane Varieties	Vijay Kumar Agricultural Research station, Basanthpur – Mamidigi
15.11-15.20	TS-II-17	New approach for silicon supply mitigates drought stress on Saccharum spp. by modulating growth, photosynthetic and antioxidative enzyme activities	Krishan K. Verma Sugarcane Res Inst, GXAAS, Nanning, China
15.21-15.25	TS-II-18 (Short)	Rapid evaluation of sugarcane growth and nitrogen use efficiency based on two-dimensional automated image-based phenotyping	Dong-Liang Huang uangxi Academy of Agricultural Sciences

15.26-15.30	TS-II-19 (Short)	Indexing sugarcane phytoplasmas by applying 16S rRNA and secA gene specific primers in weed species growing in sugarcane fields of Uttar Pradesh	Shivani Gupta ICAR-Indian Agricultural Research Institute, New Delhi, India
15.31-15.35	TS-II-20 (Short)	Productivity and profitability of sugarcane with foliar application and sett treatment of potassium salt of active phosphorus (PSAP) in the peninsular zone of India	S.S. Nooli ICAR-AICRP-S, ARS, Sankeshwar, India
15.36-15.40	TS-II-21 (Short)	Productivity of sugarcane as influenced by soil and foliar application of silicon in the peninsular zone of India	S.S. Nooli ICAR-AICRP-S, ARS, Sankeshwar, India
15.41-15.45	TS-III-22 (Short)	An appraisal of parents and their progenies for yield and quality traits in sugarcane (*Saccharum* spp)	S. Alarmelu ICAR, Sugarcane Breeding Institute, Coimbatore, India
16.00-16.45		**HIGH TEA**	**ICISE**

Day III

Wednesday, September 18, 2024

Technical Session III

Sugarcane & Sugar Crops Processing, Value Chain Management, Sugar Agri-Business & Marketing

(Venue : Main Hall, Ground Floor)

Chairman : **Prof. Narendra Mohan, Ex-Director, NSI, Kanpur, India**

Co-Chairman : **Mr. R. V. Dani, Vasantdada Sugar Institute, Pune**

Coordinator 1 : **Dr. N. Gopalakrishnan, SISTA, India**

Coordinator 2 : **Dr. R. Manimekalai, SBI, Coimbatore, India**

08-30-09.00		**Bus Transfer from Hotel to ICISE**	
09.01-09.15	TS-III-01 (Lead)	Optimizing steam consumption and bagasse saving in sugar complex-A technical approach	Sanjay Awasthi, Head ISGEC Heavey Engineering Ltd. U.P, India

09.16-09.30	TS-III-02 (Lead)	Sugar industry – sustainability through cost curtailment	R.V. Dani Vasantdada Sugar Institute, Pune
09.31-09.45	TS-III-03 (Lead)	Multiple avenues of green hydrogen generation in sugar mills	RA Chandgude Vasantdada Sugar Institute, Pune , India
09.46-10.00	TS-III-04 (Lead)	Green hydrogen: A sustainable opportunity for sugar & distillery industry	Kakasaheb Konde Vasantdada Sugar Institute, Pune India
10.01-10.15	TS-III-05 (Lead)	Phytopharmaceutical importance of sugarcane and its potential health benefits	Umesh K. Patil Dr.Harisingh Gour Vishwavidyalaya (Sagar (M.P.) India
10.16-10.30	TS-III-06 (Lead)	A success story of conversion of DS process to refined sugar with mud removal system at Saraswati Sugar Mills	Anup Kesarwani Chemical Systems Technologies (I) Pvt. Ltd, New Delhi
10.31-10.45	TS-III-07	Development of sugarcane deep processing and comprehensive utilization in China	Gan-Lin Chen Guangxi Subtropical Crops Research Institute Nanning, China
10.46-10.53	TS-III-08	Unlocking agricultural potential: gamma radiation and natural polymers in climate change mitigation and crop fortification	Sunil Dalvi Vasantdada Sugar Institute, Pune, India
10.53-11.00	TS-III-09	Biorefineries of lignocellulosic biomass into sustainable high-value biochemicals and functional materials	Zhanying Zhang School of Mechanical, Medical Queensland University of Technology, Queensland, Australia
11.00-11.35	**Visit of Exhibition and Tea**		

Technical Session III (contd..)

Chairperson : **Mr. Anup Kesarwani, Director, Chemical Systems Technologies New Delhi, India**

Co-Chairman : **Dr. D.M. Rasker, Shreenath Mhaskoba Sugar, Maharashthra**

Coordinator 1 : **Dr. Vijay Kumar, ANGRAU, Hyderabad, India**

Coordinator 2 : **Mr. Sunil Dalvi, VSI, Pune, India**

11.36-11.45	TS-III-10	Decarbonization in sugar industrial complex: possibilities and its challenges	Ravi Shinivasan Amaravathi Co-Op Sugar Mills Ltd, Distillery Unit, Krishnapuram Tamilnadu, India
11.46-11.55	TS-III-11	Assessment of air pollution as influenced by in situ sugarcane trash burning	D.H. Phalke Mahatma Phule Krishi Vidyapeeth, Rahuri , India
11.56-12.05	TS-III-12	Sweet sorghum an indispensable crop for bioethanol production	Ananthalakshmi R National Sugar Institute, Kanpur, U.P., India
12.06-12.15	TS-III-13	Consequence of ethanol blending in diesel engine: A strategic analysis of performance and emission	R.A. Chandgude Vasantdada Sugar Institute, India
12.16-12.25	TS-III-14	Improve the recovery and quality of sugar by controlling microbial contamination at field and process	Simanchala Panda MRN Chamundi Cane Power and Biorefineries Pvt. Ltd
12.26-12.35	TS-III-15	Bio-based sustainable economy : A transformative possibility	Vivek Verma Managing Director, Spray Engineering Devices Limited, Mohali, Punjab, India
12.36-12.45	TS-III-16	Hybrid bagasse dryer technology – integration of waste heat recovery and flue gas cleaning	R. Verma Enviropol Engineers Pvt. Ltd, Noida, India
12.46-12.53	TS-III-17	Compressed biogas a revolutionary biofuel: A case study	D.M. Raskar Shreenath Mhaskoba Sakhar Karkhana Ltd, Pune, India

12.54-13.00	TS-III-18	Sugar industry revamp with competitive and modern concepts	Harjeet Singh Bola IPRO INDIA Private Limited, Braunschweig, Germany
13.01-13.05	TS-III-19	Integrated approach for treatment of molasses based distillery spent wash	Mahendra S Mulkalwar MM Enviro Projects Pvt Ltd, Nagpur, India
13.05-14.00		**LUNCH**	**ICISE CENTRE**
14.00-16.00		**Valedictory Session & TEA**	Main Hall, ICISE
16.00-18.00		**City Tour by bus**	
18.00-19.30		**Dinner**	Downtown Restaurant

Day IV

Thursday, September 19, 2024

KCP-VIETNAM SUGAR FACTORY VISIT, SON HOA DISTT. (OPTIONAL)

Interested delegates should contact Organizing Secretary for this tour at Registration Desk.

Buses will be available at the Hotel at 08.30 am sharp for the tour. Lunch will be served at the Factory.

Note : The delegate attending factory tour should make their own arrangement for stay in the hotel on September, 19 2024 at their own cost. Airport drops are available from the hotel on September, 19 2024 by the organizer

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4.	**Posters for Conference/Seminar/Symosium** (Up to 100 cm x 150 cm) **Package I (E-version)** : Editing/Artwork Designing **Package II (Print version) :** Editing/Artwork Designing/Color Printing including postage to destination	 5-10 15-20
5.	**Conference Promotional Material: Banners, Back Drops** (Any Size) : Designing/Composing of Back drop banners	3-5
6.	**Conference/Seminar Standee** (any size) Designing and composing/per standee (Artwork only)	3-5
7.	**Conference/Seminar/Workshop announcements and schedules** (Artwork only)	7-10
	Academic Activities	
8.	**Journal articles/ Research papers** (English Proof reading/Editing): up to 25 pages A4 size double line (Agricultural and Bio-sciences)	15-30
9.	**Short communication** : (Proof reading/Editing) up to 15 pages A4 size double line) (Agricultural and Bio-sciences)	30-45
10.	**Reviews** of Journal submissions (Agriculture & Bio sciences only) : Up to 50 pages A4 size double line (Agricultural and Bio-sciences)	60-75
11.	**Academic and scientific publications** (Proof reading/Editing) (Agricultural and Bio-sciences)	30-45
12.	**Research proposals** (Agricultural and Bio-sciences) : Editing (Up to 50 pages)	45-60
13.	**Laboratory reports and project summaries:** (Proof reading/Editing) (Agricultural and Bio-sciences)	45-60
14.	**Ph.D Thesis / Dissertations:** Editing for English language (Up to 150 pages)	90-120
15.	**Author biographies and publication lists** (20 pages)	15-25
16.	**Letters and Memos**	3-7

*Provision for print copies is also available. Written matter to be provided.

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