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International Society of Sugar Cane Technologists
Founded 1924

Bulletin

Welcome to the ISSCT Bulletin for April 2024, in which we collect latest ISSCT updates, along with news, research, and past and upcoming events related to sugar cane technology.

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ISSCT News

Mid-Term Meeting

The Mid-Term Meeting (MTM) of the Executive Committee will be held in virtual mode on 29th and 30th May 2024 to consider Administrative, Financial, Strategic Orientations and Technical/Scientific aspects of ISSCT for the period 2023-2025. In addition, the agenda will include the Centennial Volumes and the progress achieved in the implementation of the Strategic Initiatives decided at Congress in India in February 2023.

On 27th May 2024 the Technical Programme Committee (TPC) will meet to consider the organisation of the forthcoming workshops, technical aspects related to the organization of the ISSCT XXXII Centennial Congress, planning of plenary sessions, preparation of Proceedings, revision of TPC Operations Manual, Strategic Initiatives, etc.

Joint meetings of the Executive Committee will be held at the MTM with the Technical Programme Committee (TPC) and the Congress Organising Committee (COC) to consider all matters related to the XXXII Congress including Pre and Post Congress Tours, Accompanying Persons' Programme, Accommodation, Trade Exhibition, Social Activities, etc.

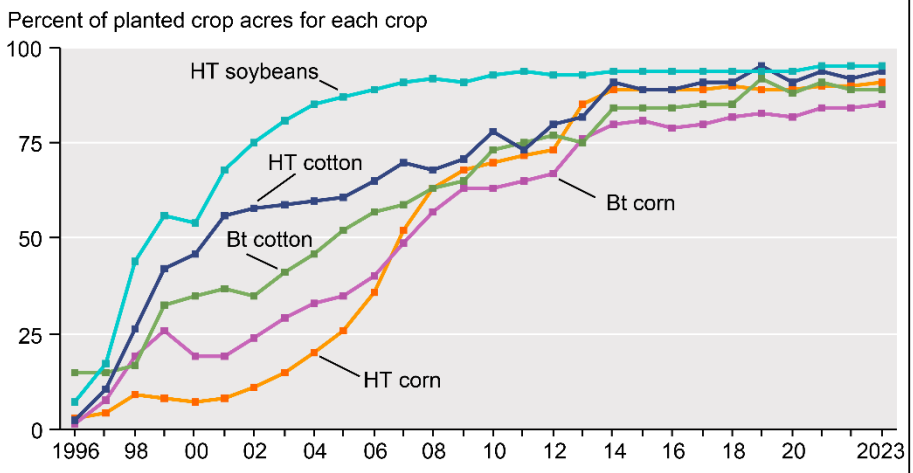
The main outcomes of these meetings will be communicated to you in the June issue of ISSCT Bulletin.

Feature: The advent of commercial transgenic sugarcane in Brazil

Introduction

Genetically modified corn, soybeans and cotton were first released for commercial cultivation in the USA in 1996 and were rapidly adopted by farmers (see Figure 1, USDA, 2023). GM soybean and cotton were particularly quickly adopted, reaching over 50% of planted area within a period of 4 years.

Adoption of genetically engineered crops in the United States, 1996–2023



Note: HT indicates herbicide-tolerant varieties; Bt (*Bacillus thuringiensis*) indicates insect-resistant varieties (containing genes from the soil bacterium Bt). Data for HT/Bt corn and cotton are not mutually exclusive, as HT and Bt categories include those varieties with overlapping (stacked) HT and Bt traits.
Source: USDA, Economic Research Service using data from the 2002 ERS report, Adoption of Bioengineered Crops (AER-810) for 1996–99 and National Agricultural Statistics Service, (annual) June Agricultural Survey for 2000–23.

In Brazil, GM corn was released in 2008, and within 5 years represented over 80% of the cultivated area (Schuster et al, 2022). In comparison, sugarcane is 20 years behind in terms of the commercial adoption of GM technology, despite the fact the research trials with transgenic sugarcane have been around since the mid-1990s (see Budeguer et al, 2021 for a review)

First approvals for planting in Brazil

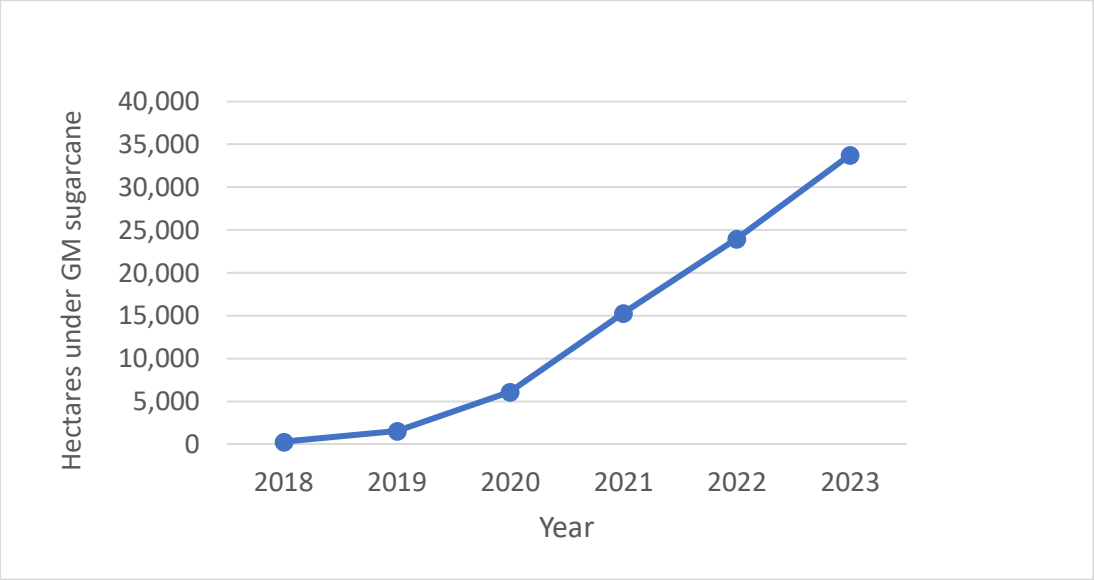
The first transgenic sugarcane approved for commercial planting was released by CTC in Brazil in 2017. CTC20BT was developed to be resistant to the sugarcane borer, *Diatraea saccharalis*, and contains the Cry1Ab introduced by particle bombardment (see Cheavegatti-Gianotto 2019 for additional details). The sugarcane borer is a significant pest in Brazil, causing a yield loss equivalent to R$ 4,9 billion per annum, estimated in 2016 (equivalent to ~US$ 1 billion, (CTC (2016)). In addition to yield loss, borer damage also reduces sugar quality and factory recovery due to increases in secondary compounds in the stalk, as well as bacterial and fungal infection in the borer damaged cane. The release of CTC20BT was followed by the development and approval for commercial release of 3 additional GM varieties in subsequent years as per Table 2, all with resistance against sugarcane borer. These varieties are only approved for planting in Brazil, and currently there are no plans to submit planting approvals in other countries.

Table 1. Transgenic sugarcane available for commercial planting in Brazil

Variety	Gene	Method	Year Approved
CTC20BT	Cry1Ab	Biolistic	2017
CTC9001BT	Cry1Ac	Agrobacterium	2018
CTC9003BT	Cry1Ac	Agrobacterium	2019
CTC7515BT	Cry1Ac	Agrobacterium	2020

The rate of adoption has been relatively rapid, especially when compared to historical adoption rates of conventional varieties. Figure 2 shows the accumulated number of hectares under GM sugarcane from 2017 to 2023. These borer resistant varieties are being planted by more than 200 clients, including large sugar mills as well as independent growers. It is anticipated that the area under transgenic sugarcane will reach more than 45,000 hectares in 2024. A key to the rapid adoption was a concerted effort to multiply planting material via meristem culture and single-budded setts, in order to provide growers sufficient planting material when the varieties were released for commercial use.

Figure 2: Area (hectares) under cultivation in Brazil with transgenic sugarcane



Refuge and resistance management.

Insect Resistance Management (IRM) practices are important to prevent insect populations evolving genetic resistance to the Cry proteins expressed in transgenic crops. CTC requires growers to plant a minimum of 20% refuge of non-GM sugarcane within 800m of GM fields to ensure that *Diatraea* populations are not exposed to high selection pressure for resistance evolution, and an auditing system is in place to ensure compliance. In addition, a sample of transgenic field are routinely monitored to look for signs of borer damage, and insects of the sugarcane borer are collected in the field to detect possible changes in the *Diatraea* population.

Food and Feed approvals

Although the CTC transgenic varieties are only approved for planting in Brazil, dossiers to approve the importation and use of sugar have been submitted in various countries. As sugar is a highly purified substance, DNA or protein of the transgene cannot be detected in sugar derived from transgenic plants. The USA, Canada and China have already given approval for the importation and use of sugar derived from transgenic sugarcane, and approval from other countries is anticipated in due course.

Client experiences

The CTC YouTube channel (in Portuguese) with clients regarding their experience with CTCs transgenic varieties. In one such account, Oscar Gomes, a grower from the Aracatuba region, describes how he achieved a productivity of 25 tons of sugar per hectare by planting CTC9001BT, together with supplementary drip irrigation, despite his farm having poor soils. In another case, the Usina (sugar mill) São Jose de Estiva achieved a yield of 17 tons of sugar per hectare. In both cases, zero damage from the borer was observed, proving the effectiveness of the transgenic technology in controlling the insect pest.

Future prospects

CTC is committed to bringing additional technologies to help growers improve cane and sugar yields. Research is underway to develop new products with additional modes of action for *Diatraea* resistance, as well as resistance to glyphosate herbicide, and bring these to the market in the short to mid-term. In addition, research in the new gene editing technologies is being conducted at the CTC Genomics laboratory in St Louis, USA, to ensure that sugarcane is not again left behind in biotechnology advances that can be applied to new challenges of sustainability, decarbonization and climate change in agriculture.



CTC9001BT on the left, and CTC9003 conventional on the right. The red labels show locations of sugarcane borer damage on the stalk, illustrating the absence of borer damage on the GM variety in the presence of high borer levels in the field.

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Dr. Michael Butterfield
Data Science and Scientific Affairs Manager
Centro de Technologia Canaveira (CTC)

Sugar Cane News

DNA breakthrough may increase sugar cane production

Food Business News	**Food Business News**	**February 4, 2024**	**https://www.foodbusinessnews.net/articles/25832-dna-breakthrough-may-increase-sugar-cane-production**
	Researchers have combined multiple techniques to map out sugar cane's genetic code, a discovery that could lead to more resilient crops and increased sugar production.		

	The researchers, through mapping out sugar cane's DNA, were able to verify the specific location that provides resistance to brown rust disease. A study on the research was published March 27 in Nature. The research was conducted as part of the Community Science Program at the US Department of Energy Joint Genome Institute (JGI), a DOE Office of Science user facility at Lawrence Berkeley National Laboratory. *This collaborative work involved Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), eRcane, Sugar Research Australia and University of Queensland.*

Sugarcane's genome is finally mapped and ready for new breeding era

earth.com NATURE · SCIENCE · LIFE	**Earth.com**	**March 29, 2024**	**https://www.earth.com/news/sugarcane-genome-finally-mapped-new-crop-breeding-era/**
	Modern hybrid sugarcane, one of the most harvested crops on the planet, has finally had its genome mapped out by a team of dedicated scientists. *This breakthrough marks a significant milestone in the field of plant genomics, as sugarcane was the last major crop without a complete and highly accurate genome due to its complex genetic blueprint.* *The research, conducted at the U.S. Department of Energy Joint Genome Institute (JGI), was led by Jeremy Schmutz. He is the Plant Program lead at the JGI and faculty investigator at the HudsonAlpha Institute for Biotechnology.* *"This was the most complicated genome sequence we've yet completed. It shows how far we've come," Schmutz explained. "This is the kind of thing that 10 years ago people thought was impossible. We're able to accomplish goals now that we just didn't think were possible to do in plant genomics."*		

NEC and Sumitomo put AI to work down on the farm

NIKKEI Asia	**Nikkei Asia**	**March 2, 2024**	**https://asia.nikkei.com/Business/Agriculture/NEC-and-Sumitomo-put-AI-to-work-down-on-the-farm**
	NEC and trading house Sumitomo Corp. are teaming up on an agricultural support service that uses artificial intelligence to analyze data to help improve yields while saving resources, aiming to support stable production amid frequent extreme weather events from climate change. *Sumitomo is involved in the agricultural materials business, including pesticides and fertilizers, in 40 countries. NEC will leverage Sumitomo's sales network to begin full operations this year in places like Brazil, India and Thailand. The service will first focus on sugar cane before expanding to grains such as wheat and soybeans.* *Expected customers include sugar companies and agricultural materials manufacturers that*		

	employ agronomists who oversee farms. Fees for the service will be based on area.

Researchers transform sugarcane by-product into slabs and bricks

New Civil Engineer	**New Civil Engineer**	**March 22, 2024**	**https://www.newcivilengineer.com/innovative-thinking/researchers-transform-sugarcane-by-product-into-slabs-and-bricks-22-03-2024/**
	A new low carbon construction material made from sugarcane by-product is emerging as a promising sustainable alternative to concrete and bricks. *Sugarcane is the world's largest crop by production and bagasse is what is left when sugar juice is extracted from it. According to international science journal Industrial Crops and Products, 513M.t of this dry fibrous material is created globally every year.* *In countries such as India, bagasse is being converted into biofuel for low-carbon electricity, but its potential to contribute to global decarbonisation could soon extend to the construction sector.*		

DG Fuels, BP and Johnson Matthey Team Up to Produce Sustainable Aviation Fuel From Sugar Cane

WSJ PRO SUSTAINABLE BUSINESS	**Wall Street Journal**	**April 10, 2024**	**https://www.wsj.com/articles/big-hitters-team-up-to-produce-sustainable-aviation-fuel-out-of-sugar-cane-a57abcd8**
	Waste biomass made from sugar cane is set to power the next generation of sustainable aviation fuels, with a new $4 billion plant scheduled to be built in the farmlands of Louisiana. Renewable hydrogen producer DG Fuels, energy giant BP and chemicals maker Johnson Matthey plan to produce 180 million gallons of sustainable aviation fuel, or SAF, a year in St. James Parish, Louisiana—enough for 30,000 trans-Atlantic flights annually, they said. *Washington-based DG Fuels said it will be purchasing $120 million worth of sugar cane waste a year to produce carbon monoxide—one of the key components in the production of the group's SAF. That gas will be combined with blue hydrogen to create a mixture called syngas, which can then be used to make a form of low-carbon kerosene through Johnson Matthey and BP's proprietary technology, known as Fischer Tropsch CANS.*		

Google-backed agritech firm Cropin launches open-source AI model to empower farmers

	ZeeBusiness	**April 16, 2024**	**https://www.chinimandi.com/uttar-pradesh-modern-college-for-sugarcane-seed-institute-to-be-constructed-in-tamkuhi/**
	Agritech company Cropin Technology on Tuesday launched the sector's first open-sourced micro-language model for climate-smart agriculture, targeting undeserved farmers in Global South. *The Google-backed Cropin launched 'akṣara' AI model which is designed to remove barriers to knowledge, and empower anyone in the agriculture ecosystem to build frugal and scalable AI solutions for the sector.*		

Rural farmers become the first Canaoeste members to achieve certification [Brazil]

	Bonsucro	**March 21, 2023**	**https://bonsucro.com/canaoeste-farmers-achieve-bonsucro-certification/**
	Sustainable sugarcane production in rural Brazil has taken another step forwards, as twelve producers have become the first members of farmers' association Canaoeste to achieve certification against the Bonsucro Production Standard. *Canaoeste represents 2,000 rural sugarcane farmers in the state of Sao Paulo in Brazil. It works closely with the farmers to develop their awareness of sustainable practices, and build their technical capacity to implement them, through the provision of training and information. It also advocates on the producers' behalf at industry and government meetings, and helps the farmers comply with their regulations.*		

Bonsucro signs cooperation agreement with Orplana [Brazil]

	Bonsucro	**April 11, 2024**	**https://bonsucro.com/cooperation-agreement-with-orplana/**
	On 10 April, our Head of South America, Livia Ignacio, and Gustavo Rattes de Castro, President, of the Organization of Cane Producers Associations in Brazil (ORPLANA) signed a Cooperation Agreement to work together towards greater sustainability in the sugarcane sector in Brazil. The agreement includes commitments to share knowledge and collaborate on sustainability initiatives.		

China's sugarcane belt embraces high-tech farming

ChiniMandi	**ChiniMandi**	**April 6, 2024**	**https://cosmosmagazine.com/technology/energy/from-refinery-to-biofuel-reactor/**
	As heavy rain clouds gather over Shangtang Village in Wuxuan County, Guangxi Zhuang Autonomous Region, farmers watch over their buffalo herds while unmanned tractors plough across the sugarcane fields. *During the spring ploughing season, farmers sit behind driverless sugarcane tractors, guided by the BeiDou Navigation Satellite System (BDS), to drop sugarcane seeds at regular intervals. With these automated tractors, planting, fertilizing, and mulching can be done all at once.*		

UN adopts Cuban resolution on circular economy in sugar cane

on cuba NEWS	**On Cuba News**	**March 4, 2024**	**https://oncubanews.com/en/cuba/un-adopts-cuban-resolution-on-circular-economy-in-sugar-cane/**
	The draft resolution presented by Cuba on the application of the circular economy in sugar cane was adopted this Friday by the United Nations Environment Assembly. *Under the title "Circularity of a resilient and low-carbon sugarcane agroindustry," the document, co-sponsored by Brazil, addresses the loss of biodiversity, soil degradation and pollution, as well as a source of food, raw materials, biomaterials and bioenergy.* *This is the first time in history that Cuba has presented a draft resolution before the United Nations Environment Assembly. With this step, the island invites member States with sugarcane agroindustries to integrate circular economy approaches into their respective national strategies. Likewise, adds PL, it calls for exploring and developing partnership initiatives, in cooperation with the private sector and other actors, focused on supporting the implementation of these actions.*		

Sulzer to deliver technology and key equipment to India's first bioplastics plant [India]

CHEMICAL ENGINEERING	**Chemical Engineering**	**March 18, 2024**	**https://www.chemengonline.com/sulzer-to-deliver-technology-and-key-equipment-to-indias-first-bioplastics-plant/?printmode=1**
	Sulzer Ltd. (Winterthur, Switzerland) will supply its cutting-edge polylactic acid (PLA) production technologies to Balrampur Chini Mills Limited (BCML) to support the construction of India's first bioplastics plant. The new state-of-the-art bioplastics plant will produce 75'000 tonnes of compostable, wholly recyclable bioplastic per year using sugarcane as a feedstock. It will be located adjacent to one of BCML's sugar cane processing facilities, enabling BCML to use the country's main agricultural crop to make a major contribution to the nation's sustainability aims.		

	Single-use plastic waste has been a major environmental issue in the world and many countries are encouraging the adoption of bioplastics, especially for packaging materials. Polylactic acid is a bio-based, compostable and wholly recyclable biopolymer that is produced from renewable feedstocks, such as sugar cane. The technologies required to enable the production process for this material have been developed and optimized by Sulzer. They have been designed to help industry meet the increasing global demand for high-performance, more sustainable products in an economically viable way.

Knowledge-Based Companies in Iran Sign Contract to Develop Environmentally Friendly Technologies for Sugarcane Industry [Iran]

	Azad News Agency	**March 12, 2024**	**https://ana.ir/en/news/5431/knowledge-based-companies-in-iran-sign-contract-to-develop-environmentally-friendly-technologies-for-sugarcane-industryx**
	A memorandum of understanding (MoU) was signed between the Headquarters for Development of Knowledge-Based Economy of Water, Climate and Environment and Karun Agro Industries Inc. to support the sustainable progress and complete the value chain of the sugarcane industry in Iran, including green harvesting, management of water resources, energy and agricultural waste. Mohammad Mahdi Nourbakhsh, as the Secretary of the Headquarters, represented the knowledge-based companies in conclusion of the agreement with the Karun Agro Industries Inc.		

India to assist Fiji's sugarcane farmers to study sugar industry

	ChiniMandi	**February 24 2024**	**https://www.chinimandi.com/india-to-assist-fijis-sugarcane-farmers-to-study-sugar-industry/**
	Fourteen sugarcane farmers from Fiji are will be in India to participate in a two-week customised course exclusively tailored for Fijians under the Indian Technical and Economic Cooperation Programme, facilitated by the Government of India, reported Fiji Village. *Minister for Sugar Industry, Charan Jeath Singh, announced the initiative yesterday, highlighting that the programme is fully funded by the Indian High Commission in Fiji. Singh emphasized that the scholarship opportunity aims to enhance the farmers' understanding of the industry.*		

Technology is key for sustainability of sugar sector – Sasta President, Dr Muhammad Kadwa [South Africa]

IOL	**IOL**	**February 26, 2024**	**https://www.iol.co.za/business-report/economy/sasta-technology-is-key-for-sustainability-of-sugar-sector-7ecc30e8-8719-4a67-936b-15763a224720**
	The South African sugar industry is synonymous with the rural economy, and rightly so. The industry operates in deeply rural areas of KwaZulu-Natal and Mpumalanga, where alternative jobs are minimal. The industry, especially the farming element of it, is not seen as being technologically advanced. However, this perception is far from reality. *In modern-day farming and milling, even in South Africa, technology is the nexus of the operations, thereby, providing the basis for the sustainability of the industry. A few examples of technology being embraced include highly sophisticated sugar cane breeding facilities, specialised farming implements, load cells in cane and sugar haulage vehicles, voluminous pieces of equipment in sugar mills and embracing energy-efficient processes to reduce the carbon footprint. And the industry knows that continuous improvement is essential.*		

Mitr Phol Boosts Sugarcane Leaf Program for Renewable Energy [Thailand]

Bangkok Post	**Bangkok Post**	**February 23, 2024**	**https://www.bangkokpost.com/thailand/pr/2747356/mitr-phol-boosts-sugarcane-leaf-program-for-renewable-energy**
	Mitr Phol Group reinforces its commitment to sustainable development by continuing its sugarcane leaf purchase program from sugarcane farmers, thereby enhancing the value of agricultural waste. For over six years, the program has promoted green sugarcane harvesting and utilised sugarcane leaves as raw material for bio-power generation Mitr Phol Group has been a pioneer in developing processes for renewable energy production, utilising sugarcane leaves as a fuel source for biomass electricity.		

Texas' Last Remaining Sugar Cane Grower Is Shutting Down [USA]

yahoo!news	**Yahoo News**	**February 25, 2024**	**https://uk.news.yahoo.com/texas-last-remaining-sugar-cane-032452285.html?guccounter=1&guce_referrer=aHR0cHM6Ly9uZXdzLmdvb2dsZS5jb20v&guce_referrer_sig=AQAAAF9c6OqX3Lyv7-rhV2MIZl6MLp-8gSh91O-EWTDjGxmPp1g3BZ-cvGFnARCpevl0T8rdMZV_Wbgk8Ik4vdXjVonp461lPieCV06gA-kGJYcZtI-3SZyUvwwzLiDzFGqkMuJuUQf9fswW7h92j94TU_noywyPSTXJdZEctn4IvWAW**
	It's the end of a long era in the sugar cane-growing region of South Texas. For much of the 1800s, the		

	Lone Star State was the second-leading sugar producer in the United States. After a period of growth, Texas produced 998,000 tons of cane sugar in 1980. But times have changed. Between 2023 and 2024, the state produced roughly 44,000 tons. Now the final sugar cane grower, Rio Grande Valley Sugar Growers, Inc. will end operations after the current crop is processed. In a press release, the company cited a lack of dependable water supply as the reason for closing. Currently, more than 500 people are employed in sugar growing and milling, both full-time and seasonally in the Rio Grande Valley, and the industry is a major economic driver in the area.

Latest Research

Sustainable and eco-friendly membranes from sugarcane bagasse: An upcycling approach for wastewater treatment and energy storage



Developing eco-friendly alternatives to synthetic membranes is crucial in advancing modern membrane technology for water purification. In a pioneering effort, sustainable free-standing Forward Osmosis (FO) membranes composed of cellulose-derived from waste agricultural sugarcane bagasse (SBC) and PVA were developed. These membranes represent a novel upcycling approach, offering both biodegradability and sustainability while ensuring the production of high-quality water. Various analytical techniques were employed to characterize the SBC and membranes. The SBC exhibited a surface area of 1.9 m^2 g^{-1}, as determined by BET analysis and was rich in various functionalities. Membrane contact angle measurements revealed their hydrophilic nature. The optimized membrane, SBC-15-DS, demonstrated remarkable performance with an osmotic water flux (OWF) of 9.5 ± 0.2 L $m^{-2}h^{-1}$, reverse solute flux (RSF) of 0.23 ± 0.01 mol $m^{-2}h^{-1}$, and specific solute flux (SSF) of approximately 0.009 mol L^{-1}, achieving > 99 % retention for all pollutants. Notably, flux rates of 11 to 14 L $m^{-2}h^{-1}$ with 99 % rejection were attained for various real industry wastewaters. The SBC-15-DS membrane exhibited excellent stability over 216 h without backwashing, and its biodegradability was confirmed through mulching. Furthermore, fouled membranes were recycled through pyrolyzing at 900 °C, yielding carbon for fabricating supercapacitor electrodes. These electrodes exhibited a specific capacitance of 115 F g^{-1} at a current density of 0.1 A g^{-1}. Thus, these membranes hold promise for the advancement of sustainable and eco-friendly water purification methods in FO processes.

Journal to be published: May 15, 2024, article available online now

> **Link**

Promoting Adoption of Soil Health Related Regenerative Agriculture Practices Amongst Small-Scale Sugarcane Grower Communities in South Africa

The term 'regenerative agriculture' describes a rehabilitation and conservation approach to farming, which aims to enhance the sustainability of production. The approach consists of an array of practices that focus on the maintenance and rehabilitation of soil health. In the South African sugar industry, major soil related problems include: (a) soil erosion; (b) compaction; (c) acidification; and (d) soil salinity/sodicity. While regenerative practices to guide growers have been developed at the South African Sugarcane Research Institute (SASRI), the remediation of poor soil health in the industry has generally been hampered by low levels of adoption of these practices. The importance of the small-scale grower (SSG) sector to economic development has been recognised as a key element of the South African Sugarcane Value Chain Master Plan to 2030, which aims to ensure the long-term sustainability of the industry. To understand the barriers to adoption, SASRI conducted a survey of a small-scale grower community. This revealed that conventional knowledge exchange methods were ineffective with SSGs. Consequently, SASRI is developing and implementing knowledge exchange approaches which are founded on: (a) networks of demonstration plots where regenerative practices can be showcased and (b) participative research methodologies which aim to empower SSGs in discovering their own practical solutions to production challenges. Complementing these is an initiative to upskill extension specialists and agricultural advisors in soil health regenerative practices supported by regular radio broadcasts and newsletters. In the short term, the impact of these knowledge exchange tactics is being monitored through analysis of SSG production and economic data by SASRI, in collaboration with stakeholders from the local grower associations and mills. To date, data from the small-scale grower community study indicated that the implementation of the demonstration plot methodology focused on matching variety to soil type has had a positive impact on SSG livelihoods.



Published: April 3, 2024

> **Link**

A chromosomal-scale genome assembly of modern cultivated hybrid sugarcane provides insights into origination and evolution

nature communications

Sugarcane is a vital crop with significant economic and industrial value. However, the cultivated sugarcane's ultra-complex genome still needs to be resolved due to its high ploidy and extensive recombination between the two subgenomes. Here, we generate a chromosomal-scale, haplotype-resolved genome assembly for a hybrid sugarcane cultivar ZZ1. This assembly contains 10.4 Gb genomic sequences and 68,509 annotated genes with defined alleles in two sub-genomes distributed in 99 original and 15 recombined chromosomes. RNA-seq data analysis shows that sugar accumulation-associated gene families have been primarily expanded from the ZZSO subgenome. However, genes responding to pokkah boeng disease susceptibility have been derived dominantly from the ZZSS subgenome. The region harboring the possible smut resistance genes has expanded significantly. Among

them, the expansion of WAK and FLS2 families is proposed to have occurred during the breeding of ZZ1. Our findings provide insights into the complex genome of hybrid sugarcane cultivars and pave the way for future genomics and molecular breeding studies in sugarcane.

Published: April 8, 2024

> Link

Identification of a sugarcane bacilliform virus promoter that is activated by drought stress in plants

communications biology

Sugarcane (Saccharum spp.) is an important sugar and biofuel crop in the world. It is frequently subjected to drought stress, thus causing considerable economic losses. Transgenic technology is an effective breeding approach to improve sugarcane tolerance to drought using drought-inducible promoter(s) to activate drought-resistance gene(s). In this study, six different promoters were cloned from sugarcane bacilliform virus (SCBV) genotypes exhibiting high genetic diversity. In β-glucuronidase (GUS) assays, expression of one of these promoters ($P_{SCBV\text{-}YZ2060}$) is similar to the one driven by the CaMV 35S promoter and >90% higher compared to the other cloned promoters and Ubi1. Three SCBV promoters ($P_{SCBV\text{-}YZ2060}$, $P_{SCBV\text{-}TX}$, and $P_{SCBV\text{-}CHN2}$) function as drought-induced promoters in transgenic Arabidopsis plants. In Arabidopsis, GUS activity driven by promoter $P_{SCBV\text{-}YZ2060}$ is also upregulated by abscisic acid (ABA) and is 2.2–5.5-fold higher when compared to the same activity of two plant native promoters ($P_{ScRD29A}$ from sugarcane and $P_{AtRD29A}$ from Arabidopsis). Mutation analysis revealed that a putative promoter region 1 (PPR1) and two ABA response elements (ABREs) are required in promoter $P_{SCBV\text{-}YZ2060}$ to confer drought stress response and ABA induction. Yeast one-hybrid and electrophoretic mobility shift assays uncovered that transcription factors ScbZIP72 from sugarcane and AREB1 from Arabidopsis bind with two ABREs of promoter $P_{SCBV\text{-}YZ2060}$. After ABA treatment or drought stress, the expression levels of endogenous ScbZIP72 and heterologous GUS are significantly increased in $P_{SCBV\text{-}YZ2060}$:GUS transgenic sugarcane plants. Consequently, promoter $P_{SCBV\text{-}YZ2060}$ is a possible alternative promoter for genetic engineering of drought-resistant transgenic crops such as sugarcane.

Published: March 26, 2024

> Link

Differentiating Bagasse and Straw as Feedstocks for Sugarcane Cellulosic Ethanol: Insights from Pilot-Scale Pretreatments

Bagasse and straw are the two feedstocks used to produce cellulosic ethanol from sugarcane. Although this technology is advancing commercially, the differentiation between bagasse and straw remains elusive. This work investigates bagasse and straw supply, conditioning, and pretreatment in a pilot-scale steam-explosion continuous

reactor (~ 10 kg/h feed) to illuminate the critical feedstock differences for process scale-up. Evaluating biomass across four sequential harvest seasons (2018–2021) shows that straw supplied in bales requires extra conditioning to reduce mineral matter and particle size before feeding into the reactor. Moreover, straw composition is more variable and consistently has lower contents of glucan (35.6–38.8%) and carbohydrate potential (glucose + xylose, 649–704 kg/dry tonne) compared to bagasse (40.8–42.9%; 735–760 kg/dry tonne). Biomass pretreatments without (190 °C, 5–15 min) and with sulfuric acid catalyst (149–170 °C; 5–15 min; 0.5–5.12%, m/m) show that straw differs from bagasse by presenting a higher acid neutralization capacity and about 5% of labile glucans. These results suggest that straw crushing and aqueous pre-extraction are promising strategies to reduce the dissimilarities with bagasse, thus facilitating the development of feedstock-agnostic biorefining.

Published: April 13, 2024

> Link



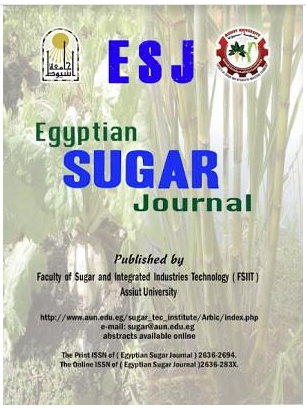
CNN and LSTM Approach for Soil Nutrient analysis for Sugarcane Crop

A new paradigm has been adopted in agricultural techniques, tools, and technology. To guarantee the implementation of site-specific crop management, which includes soil nutrient treatments according to crop requirements, precision agriculture is crucial. Soil nutrients are a major component in determining the growth of precision agriculture, which has gained global attention. One of the main challenges is more effective nutrient content detection as it guides well-planned nutrient-level-boosting routines. Many approaches, such using research labs and additional mobile labs, haven't shown to be very useful in helping farmers control their soil fertility. Taking advantage of the breakthroughs is severely hampered by factors like lack of knowledge and distance from research centers. In the work proposed, LSTM based RNN is employed to predict the Ph and nutrient values of the soil measured through microcontroller using sensor from the agricultural field. At the same time, RELU-CNN approach is applied to the soil images for measuring the same values. The values obtained from both the approaches are compared against each other so that the method may be made directly available to the farmers for evaluating the nutrient level of the soil and take necessary action. The approaches are measured in terms of quality parameters Recall, F1-Score, Accuracy, Precision and RMS value.

Published: April 10, 2024

> Link

Weed and disease management strategies for sustainable sugar cane production



Weed and disease management strategies for sustainable sugarcane production were investigated by using two sugarcane genotypes, Bida local and commercial NCS 001, four rates of sugarcane trash mulch rates of 0, 3, 6, 9 t ha-1 and four weed management practices namely weedy check, monthly hoe weeding for five months (5 MHW), application of PE diuron + POE 3 – maize force, and application of PE diuron plus POE 3 – maize force + 2 MHW at Badeggi (Lat. 9o 45´N, Long. 06o 07´E). The treatments were arranged in a split-plot design and replicated three times in 2016 and 2017 cropping seasons. Results showed that application of 6 t ha-1 mulch produced comparable but lower weed dry matter and whip smut incidence to 9 t ha-1 mulch. Application of PE diuron plus POE 3 – maize force and 5 MHW, resulted in a comparable weed dry matter and whip smut incidence to PE diuron plus POE 3 – maize force plus 2 MHW. Similarly, PE diuron plus POE 3 – maize force, 5 MHW and PE diuron plus POE 3 – maize force plus 2 MHW produced comparable stalks and brix content, number of stools and millable stalks. Also, 5 MHW generated taller sugarcane plants. The application of PE diuron plus POE 3 – maize force proved equally effective as 5 MHW in contributing the highest cane yield. Lower weed dry matter was recorded in Bida local, and taller stalks, maximum cane girth, higher brix content, number of stools, millable stalks, lower whip smut incidence and cane yield were recorded in NCS 001. In all, application of 9 t ha-1 trash mulch with 5 MHW or PE diuron plus POE 3 – maize force plus 2 MHW or PE diuron plus POE 3 – maize force strategies effectively managed weeds and smut incidence in the present study. The strategies also increased stalk height, cane girth, brix content, number of stools, millable stalks and cane yield of genotype NCS 001.

Published: December 2023

> Link

Challenges of Digital Solutions in Sugarcane Crop Production: A Review

AgriEngineering

Over the years, agricultural management practices are being improved as they integrate Information and Communication Technologies (ICT) and Precision Agriculture tools. Regarding sugarcane crop production, this integration aims to reduce production cost, enhance input applications, and allow communication among different hardware and datasets, improving system sustainability. Sugarcane mechanization has some particularities that mandate the development of custom solutions based on digital tools, which are being applied globally in different crops. Digital mechanization can be conceived as the application of digital tools on mechanical operation. This review paper addresses different digital solutions that have contributed towards the mechanization of sugarcane crop production. The process of digitalization and transformation in agriculture and its related operations to sugarcane are presented, highlighting important ICT applications such as real-time mechanical operations monitoring and integration among operations, demonstrating their contributions and limitations regarding management efficiency. In addition, this article presents the major challenges to overcome and possible

guidance on research to address these issues, i.e., poor communication technologies available, need for more focus on field and crop data, and lack of data interoperability among mechanized systems.

Published: April 3, 2024

> Link

A Novel Approach to the Sterile Insect Technique (SIT) for *Eldana saccharina* Management in South Africa



In South Africa, the stalk borer Eldana saccharina is an indigenous pest that significantly reduces sugarcane yield. Severe economic losses due to E. saccharina in the South African sugarcane industry are estimated at approximately US$60 million annually. Researchers at the South African Sugarcane Research Institute (SASRI) have researched this topic for many years to develop tools to enable sugarcane growers to manage this pest sustainably according to integrated pest management principles, with the sterile insect technique (SIT) being one of these tools. For more than three decades, the SIT has been used in area-wide integrated pest management (AW-IPM) programmes to manage pests of agricultural crops. SIT-based research has been conducted to control dipteran pests; however, controlling lepidopterans has been difficult because of their resistance to irradiation used to sterilize moths. Nevertheless, recent research on the application of SIT has proven successful in controlling lepidopteran pests. This paper provides an overview of the SIT background and studies conducted in South Africa on the SIT programme to control this key pest in sugarcane.

Published: April 2, 2024

> Link

Impact of Wonder Cane Varieties on Sugar Production, Consumption and Prices in India



Being the largest consumer of sugar, India had relied on sugar imports during the first decade of twenty-first century. However, advent of wonder varieties developed by Sugarcane Breeding Institute of the Indian Council of Agricultural Research (ICAR-SBI) has revolutionized sugar production since 2010, and the country has turned into a sugar exporter since 2016. The objective of the study is to analyse the impact of such wonder varieties on sugar production, consumption and prices. Here, sugar prices were compared with the WPI of primary articles and analysed for a possible difference in the prices with and without adjusting for inflation. It was found that, sugar prices were lesser than the inflation adjusted sugar price during the study period (2010–2022), depicting the impact of production surplus in meeting the rise in consumption demand. Although domestic sugar prices were over and above the global sugar prices, the prices remained stable with no short-term spike in the sugar prices. It is therefore evident that the wonder varieties have not only created production surplus but also stabilized sugar

prices during the study period. Using the historic time series data, ARIMA results revealed that the demand for sugar would be around 341.64 lakh tonnes by 2032–33, which is expected to grow at an annual average rate of 1.55 per cent per annum. The study suggests a sustained sugarcane and sugar production in the country to protect the domestic market from global price shocks taking into account the fuel ethanol production for EBP (ethanol blended petroleum) programme.

Published: April 1, 2024

> **Link**

Scientific Research on Bioethanol in Brazil: History and Prospects for a Sustainable Biofuel



Despite the need for a sustainable energy resource, bioenergy gained its spotlight in the 2000s. Sugarcane is a significant crop in terms of sugar and energy capacity, and it can be an alternative energy source to mitigate the effects of climate change. Bioenergy production from sugarcane in Brazil is one of the most efficient. This production lends a centrality to biofuels' importance in confronting the effects of climate change. The present article reviews the Brazilian history of this crop as a biofuel source. We highlight the historical changes related to scientific, technological, industrial, and environmental advances since the beginning of the 20th century. We describe how creating governmental institutes and disseminating scientific knowledge strengthened public policies that led Brazil to occupy leadership positions in producing, distributing, and using bioenergy throughout the country. The compiled data shows the improvement and the new approaches needed in ethanol sugarcane. We developed a bibliometric analysis to evaluate Brazilian science's contribution to this process compared to other countries. Brazil's history of science and investments in sugarcane biofuel development for transportation may be divided into two phases: ethanol-only and flex-fuel cars. A third phase is starting, which is the ethanol-to-hydrogen era.

Published: March 29, 2024

> **Link**

A new automatic sugarcane seed cutting machine based on internet of things technology and RGB color sensor

PLOS ONE

Egypt is among the world's largest producers of sugarcane. This crop is of great economic importance in the country, as it serves as a primary source of sugar, a vital strategic material. The pre-cutting planting mode is the most used technique for cultivating sugarcane in Egypt. However, this method is plagued by several issues that adversely affect the quality of the crop. A proposed solution to these

problems is the implementation of a sugarcane-seed-cutting device, which incorporates automatic identification technology for optimal efficiency. The aim is to enhance the cutting quality and efficiency of the pre-cutting planting mode of sugarcane. The developed machine consists of a feeding system, a node scanning and detection system, a node cutting system, a sugarcane seed counting and monitoring system, and a control system. The current research aims to study the pulse widths (PW) of three-color channels (R, G, and B) of the RGB color sensors under laboratory conditions. The output PW of red, green, and blue channel values were recorded at three color types for hand-colored nodes [black, red, and blue], three speeds of the feeding system [7.5 m/min, 5 m/min, and 4.3 m/min], three installing heights of the RGB color sensors [2.0 cm, 3.0 cm, and 4.0 cm], and three widths of the colored line [10.0 mm, 7.0 mm, and 3.0 mm]. The laboratory test results s to identify hand-colored sugarcane nodes showed that the recognition rate ranged from 95% to 100% and the average scanning time ranged from 1.0 s to 1.75 s. The capacity of the developed machine ranged up to 1200 seeds per hour. The highest performance of the developed machine was 100% when using hand-colored sugarcane stalks with a 10 mm blue color line and installing the RGB color sensor at 2.0 cm in height, as well as increasing the speed of the feeding system to 7.5 m/min. The use of IoT and RGB color sensors has made it possible to get analytical indicators like those achieved with other automatic systems for cutting sugar cane seeds without requiring the use of computers or expensive, fast industrial cameras for image processing.

Published: March 29, 2024

> **Link**

Events

Africa Sugar

11th Annual Africa Sugar Conference

Africa Sugar Group

24-25 April 2024

Radisson Blu Hotel, Upper Hill, Nairobi, Kenya

> **Link**

SIT Annual Technical Meeting 2024

Sugar Industry Technologists (SIT)

28 April – 1 May 2024

Vancouver, Canada

> **Link**



International Raw Cane Sugar Manufacturer's Institute

Nicholls State University

28 May – 7 June 2024

Thibodaux, Louisiana, USA

> **Link**

AZCUBA GRUPO AZUCARERO	**Diversification 2024** *Instituto Cubano de Investigaciones de los Derivados de la Caña de Azúcar* **24-28 June 2024** **Havana, Cuba** > **Link (English)** > **Link (Español)**
ASSCT AMERICAN SOCIETY OF SUGAR CANE TECHNOLOGISTS	**Annual Joint Meeting** *American Society of Sugar Cane Technologists (ASSCT)* **26-28 June 2024** **New Orleans, USA** > **Link**
International Society of Sugar Cane Technologists Founded 1924	**ISSCT 13th Germplasm & Breeding / 10th Molecular Biology Workshop** *International Society of Sugar Cane Technologists (ISSCT) / ICAR-Sugarcane Breeding Institute, Coimbatore, India / Society for Sugarcane Research and Development (SSRD)* **8-12 July 2024** **Coimbatore, India** > **Link**

	96th SASTA Congress 2024 *SASTA – South African Sugar Technologists' Association* **13-15 August 2024** **ICC, Durban** **45 Bram Fischer Rd** **Durban, 4001 South Africa** > **Link**
	Fenasucro & Agrocana 2024 *Fenasucro* **13-16 August 2024** **Sertãozinho – SP, Brazil** > **Link**
	ISSCT Agriculture Commission Workshop, Agricultural Engineering, Agronomy and Extension Sections *International Society of Sugar Cane Technologists (ISSCT) / Thailand Society of Sugar Cane Technologists (TSSCT)* **19-22 August 2024** **The Zign Hotel, Pattaya, Chonburi, Thailand** > **Link**

10th Edition Sugarex THAILAND 2024	**SugarEx Thailand** *Fireworks Exhibitions and Conferences* **12-13 September 2024** **Khonkaen International Convention & Exhibition Center (Kice), Khonkaen, Thailand** > **Link**
International Society of Sugar Cane Technologists Founded 1924	**ISSCT XIII Co-Products Workshop** *International Society of Sugar Cane Technologists / eRcane* **15-20 September 2024** **Saint-Gilles, La Réunion** > **Link**
	**8th IAPSIT International Sugar Conference ISC-2024 and Sugarcon 2024** *International Association of Professionals in Sugar & Integrated Technologies (IAPSIT), Society for Sugar Research & Promotion (SSRP) and International Centre for Interdisciplinary Science & Education (ICISE)* **16-19 September 2024** **International Centre for Interdisciplinary Science and Education (ICISE), Quy Nhon, Binh Dinh, Vietnam** > **Link**

International Society of Sugar Cane Technologists Founded 1924	**ISSCT Joint Engineering and Processing Workshop** *International Society of Sugar Cane Technologists / ISSCT Regional Group of the Federal Republic of Germany* **6-10 October 2024** **Hotel Meliá, Berlin, Germany** > **Link**
	**33rd International Sugar Organization Seminar** *ISO – International Sugar Organization* **26-27 November 2024** **London, UK** > **Link**
International Society of Sugar Cane Technologists Founded 1924	**ISSCT XIII Pathology and XI Entomology Joint Workshop** *International Society of Sugar Cane Technologists / SATCA* **25-29 November 2024** **Salta, Argentina** > **Link**



ISSCT XXXII Centennial Congress

International Society of Sugar Cane Technologists / Asociación Colombiana de Tecnicos de la Caña de Azúcar (TECNICAÑA).

21-31 August 2025

Centro de Eventos Valle del Pacifico, Cali – Colombia

> **Link**