

SHARKARA

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NATIONAL SUGAR INSTITUTE

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SHARKARA

**Volume-49, No - 01
JANUARY-MARCH, 2018**

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From Director's Desk.....



Expressing concerns over rising cane price arrears which have reached to the extent of Rs. 20,000 crores, the Government of India has advised state governments to direct sugar factories to clear the cane dues & consider taking action against defaulting sugar factories. On the other hand, sugar prices in whole sale markets registered decline despite government decision on export of 2.0 million tonnes of sugar following abundant availability of stocks on relentless arrivals from sugar mills. The sugar prices ruling in various states have created a panic as the sugar factories are apprehensive for any profits emerging out of sugar business during the year.

As I have been emphasizing repeatedly the sugar factories are required to reduce their dependency only on sugar by creating value addition through diversification as with 80-90 % of the total revenue coming from sugar, such situation is difficult to handle. Factories have to look forward towards conversion of conventional sugar plants into Bio-refineries along with branding of Indian sugars. With surplus sugar production expected during the next crushing season as well, it is the high time to work on different options and make policy intervention. A long term strategy including production of sugars as per global requirements, ethanol production for balancing the demand-supply position of sugar besides making available more ethanol for EB 10 and diversification for value added product needs to be worked out.

I wish sugar business to remain sweet.

(Narendra Mohan)
Director

➤ OUR RESEARCH AREAS:

The Institute is actively involved in the collaborative endeavors with the sugar and allied industries for developing innovative techniques and technologies for improving the overall profitability of the sugar industry.

➤ RESEARCH:

The Institute during the period took up R&D work on the following:

1. Mushroom cultivation from different lignocellulosic substrates- To explore possibilities of utilization of bagasse as substrate for mushroom cultivation, studies have been taken up which shall be extended further using other lignocellulosic substrates. A repeat set of *Pleurotus sajor caju* (taking the same combinations of substrates) was inoculated with spawn. Initial analysis of raw materials was carried out and good mycelial growth was observed after 14 days in all the bags. The samples were analysed for protein, carbohydrate, hemicellulose, cellulose and lignin contents after 7 and 14 days. The work has been completed and it was observed that the yield of mushrooms on various substrates ranged from 75 to 85%.



2. Isolation and purification of yeast strains from saccharine materials and their performance for fermentative production of alcohol- The objective of this research is to isolate and purify yeast strains from different saccharine materials and test their efficiency onto molasses medium.



Different saccharine materials chosen for the study: Hibiscus, Sugar, Jaggery, Spoilt Sugarcane Juice, Grapes and Fig. Among them Spoilt Sugarcane juice gave the best results. Therefore, the further study was carried out taking Spoilt Sugarcane juice and Active dry yeast (As Control). To check its efficiency, Molasses medium was prepared ranging 13-21% TRS. Pure Yeast culture developed from spilt cane juice was inoculated on to the diluted molasses medium with nutrients (Urea and Phosphate). The strain isolated from Spoilt Sugarcane juice was named (NSI/BC/114) proved to give same yield as ADY (used as control). New developed yeast strain (NSI/BC/114) was released by Honorable Secretary Shri Ravikant on 23rd of Jan.2018.

3. Alcohol fermentation by immobilized yeast cells - After literature survey, a preliminary set was prepared using yeast cells impregnated in the alginate beads and the performance of this set was evaluated on to molasses medium in order to achieve better yield of alcohol in less time and better reusability. The yeast cells entrapped in alginate beads at a concentration of 6:12 (ratio g) gave very good results and it has already been used upto 5 cycles and the performance has been more or less consistent with FE value of around 90% with alcohol content in wash was around 8.5% with an initial sugar of around 14.5%.

4. Bio CNG from Press mud- With an aim to utilize the press mud for production of Bio-CNG, different combinations of press mud, farm, yard manure and spent wash were tried on laboratory scale. Overall gas formation patterns in ten selected treatments were studied with the help of gas analyzer. Physico-chemical analysis of the slurry of combinations giving better results is in progress. Analysis of bio-manure residue obtained after the production of biogas for inorganic constituents, organic nitrogen and phosphorus has been completed. Trials on pilot plant are being carried out and results awaited.



5. Studies on clarification of cane juice with bagasse derived bio char- The study has been taken up with an aim to utilize the bagasse fly ash in combination with bio char to check its clarification efficiency on cane juice and other sugar liquors. Several experiments have been performed to establish the optimum condition for utilizing fly ash as clarifying aid in sugar cane juice clarification. Based on these experiments, upto 20 % reduction in colour and upto 40 % reduction in turbidity of clarified cane juice using bagasse fly ash as clarifying aid was observed.

6. Studies on synthesis of glycosidic surfactants using by-product resources of sugar industry - Studies have been taken up further so as to enhance the yield of bagasse derived polypentosides based surfactant along with reducing the purification steps involved thereof. Synthesis of bagasse derived glycosidic surfactant towards validating the method by procuring the bagasse from three sugar factories has been carried out. Additionally, an attempt has been made to synthesize glycosidic surfactant utilizing sugarcane trash as source of hemi-cellulosic sugar. The isolation and characterization of the products is under process.



7. Preservation of Sugarcane juice involving Pulsed Electric Field technique (PEF)-With aim to develop a process for sugarcane juice preservation, The PEF technique is proposed to be tried on laboratory scale. The procurement of the required chemicals and other materials-experimental set up is under process.

8. Studies on Production/isolation of C5-Sugar Alcohol/Sugar using by-product resources of sugar industry-The studies aimed basically deriving a low calorie sweetener from bagasse for which an up to date literature survey on the topic has been completed. Determination of pentosane percent in sugarcane trash as well as bagasse has been made. Isolation and characterization of xylan from sugarcane trash as well as bagasse is under process.

9. Improvement in Sugar Quality by clarification of intermediate boiling house products-In order to improve sugar quality laboratory experiments were conducted in two commercial sugar factories carrying out physico-chemical clarification of intermediate process liquors e.g. A light, melt, A heavy etc. Results are being complied & inference will be drawn thereafter. Samples of various intermediate molasses have also been collected from two more commercial sugar factories. Analysis of the samples is under progress. Previous experiments show that treatment of intermediate boiling house products with phosphoric acid, flocculants and hydrogen peroxide alongwith centrifugation gives about 4-6% reduction in colour and 60-70% reduction in turbidity which can improve the quality of sugar significantly.

10. Trials with Super Short Retention Time Clarifier.-Trials with prototype of SSRT Clarifier were carried out in February, 2018 at Experimental Sugar Factory of the institute. Analysis was also done for comparison of its clear juice quantity with that obtained from conventional clarifier. Analysis of data obtained is in progress. Preliminary results indicated

that quality of clear juice from SSRT Clarifier was more or less equivalent to the clear juice obtained from conventional clarifier.



➤ **RESEARCH PAPERS/ POSTER / PRESENTED / PUBLISHED/ SENT FOR PUBLICATION:**

1. **“Pot-efficient synthesis of renewable surfactant using sugarcane derived lignocellulosic biomass”** by Narendra Mohan, Vishnu Prabhakar Srivastava and Anushka Agarwal presented as poster in 22nd Chemical Research Society of India (CRSI) National Symposium in Chemistry, held on February 2-4, 2018 at School of Studies in Chemistry, Pt. Ravi Shankar Shukla University Raipur, Chhattisgarh.

2. **“Alternative Sweeteners as sugar substitute: incentive, influence & innovation”** by Narendra Mohan, Vishnu Prabhakar Srivastava and Anushka Agarwal presented as a Poster in “National Food Conference on Agriculture and Technology Innovations for Nutritional Security-NFC 2018” held from 9-10th February, 2018 at Centre of Food Technology, University of Allahabad, U.P.

3. **“New Technique for Effluent Treatment in Sulphitation Sugar Factories”** by Narendra Mohan & A. Bajpai sent for publication in Annual Conference of South African Sugar Technologist Association, Durban, South Africa to be held in August, 2018.

4. **“Indian Molasses based Distillery: Ethanol & Power Export Potential”** by J.P. Srivastava, A.K. Kanaujia & S. Chauhan presented during the conference jointly organized by NSI and Co-gen India at Lucknow on 15th March 2018.

5. **“Green Energy for the Indian Sugar Industry: A Sustainable Energy Future”** by Narendra Mohan, D. Swain & A.K. Kanaujia presented during 6th IAPSIT International Sugar Conference held in Thailand on March, 2018.

➤ OUR PROVISIONS:

➤ HON'BLE PRESIDENT AWARDS INSTITUTE DIRECTOR:

1. Hon'ble President of India conferred “Excellence in Science” award to Prof. Narendra Mohan, Director for ***“Excellence in Science”*** during the International Conference Agricon 2018. Hon'ble President of India who inaugurated the conference also visited institute stall and took keen interest to know about the institute activities with regards to teaching /training programmes and consultancy services.



➤ INSTITUTE GETS AWARD FOR ITS CONTRIBUTION TO SUGAR INDUSTRY:

राष्ट्रीय शर्करा संस्थान, कानपुर को “Global Education Leadership Award-2017” से सिक्किम के पूर्व राज्यपाल श्री वाल्मीकि प्रसाद सिंह पूर्व (आईएस) के द्वारा दिनांक 23 फरवरी 2018 को संसद क्लब, नई दिल्ली में नवाजा गया। संस्थान की ओर से यह पुरस्कार श्री डीनस्वे प्रोफेसर शर्करा अभियांत्रिकी ने प्राप्त किया। संस्थान को यह पुरस्कार शर्करा प्रौद्योगिकी के क्षेत्र में विशिष्ट अनुसंधान एवं रोजगारोन्मुखी विकास कार्य करने तथा शिक्षा एवं परामर्श के क्षेत्र में विशेष योगदानके लिये दिया गया है।

➤ SECRETARY (FOOD & PUBLIC DISTRIBUTION) VISITED INSTITUTE:

Shri Ravikant, Secretary (Food & Public Distribution) and Shri S. Panda, Joint Secretary (Sugar & Admn), Government of India, visited Institute on 23rd January, 2018 to review the working & plan for future activities.



During the visit, Secretary (Food & Public Distribution) laid the foundation stone of Training Center and Hostel cum Guest House. He visited institute's various laboratories and released “Yeast Strains” developed by Biochemistry division of the Institute. He also observed the

working of Bio-CNG and “Electro-coagulation pilot plant unit for waste water treatment”. During the visit, the visiting officers also planted saplings in the institute premises.

➤ BUREAU OF SUGAR STANDARDS:

The Institute on behalf of Bureau of Indian Standards prepares and issues Sugar Standard Grades to the entire Sugar Industry of the country for every sugar season. These Sugar Standard Grades are issued to facilitate quality control and to protect the interest of the common consumers. On the basis of these grades, sugar factories mark their produce accordingly.

On the basis of the approved Standards, Bureau of Sugar Standards Grades distribution commenced from 3rd October, 2017. During the period, October 2017-March 2018, 1479 nos. samples were sold to sugar factory and other users.

Price schedule for the sugar season 2017-18:

1	Sugar Standard Grades to be issued	L-31, L-30, M31, M-30, S-31, S-30 & SS-31
2	Set of New Sugar Standard Grades containing 7 grades +3 empty glass bottles + 3 Velvet Cork in packing case	Rs.10000/= each set
3	Single Sugar Standard Grade	Rs.1260/= each
4	Empty Sugar Standard Glass Bottle	Rs.200/= each
5	Packing case	Rs.430/= each
6	Velvet Cork	Rs.50/= each
7	Postal expenses, forwarding charges, if any	Extra on actual basis
8	Demand Draft to be sent	In favour of Director, National Sugar Institute , payable at Kanpur
9	Delivery of Sugar Standard Grades	Monday to Friday (10.00 AM to 5.00 PM)
10	Taxes	GST extra as applicable

➤ SEMINAR/WORKSHOP/TRAINING PROGRAMMES:

➤ TRAINING PROGRAMME ORGANIZED:

1. One day workshop/views sharing session on draft Charter for sugar factories situated in river Ganga Basin was organized by NSI on 23rd March, 2018 at NSI, Kanpur. Consensus was made on formulating four different category of factories on the basis of type of sugar produced & power generation carried out & fixing the norms for effluent discharge accordingly.



➤ SEMINARS / WORKSHOPS / CONFRENCES ORGANISED / ATTENDED:

1. Institute participated in the International Conference & Agri Expo 2018 on “Sustainability of Smallholder Agriculture in Developing Countries under Changing Climatic Scenario” organized by the Society of Agricultural Professionals & University of Agriculture & Technology from 14-17th February 2018, at Kanpur.



2. Dr. V.P. Srivastava, Asstt. Prof. of Organic Chemistry attended the 22nd Chemical Research Society of India (CRSI) National Symposium in Chemistry, organized by, Pt. Ravi Shankar Shukla University Raipur, Chhattisgarh from February 2-4th, 2018 at School of Studies in Chemistry. During the Symposium, Dr. Srivastava presented a research paper on “Pot-Efficient Synthesis of a Renewable Surfactant using Sugarcane derived Lignocellulosic Biomass”.

3. Shri S. K. Trivedi, Asstt. Prof. Sugar Technology and Shri Vinay Kumar, Asstt. Prof. Sugar Engineering attended one day workshop on “Patent capacity building program on Basic of IPR, Foreign patent filling, EPO tools, filling procedures and deliberations on drafting” organized by SIDBI Innovation and Incubation Center, Kanpur, IIT Kanpur in association with European

Business Technology Center (EBTC) and the European Patent Office (EPO) on 3rd February, 2018 at IIT, Kanpur.

4. Dr. V.P. Srivastava, Asstt. Prof. of Organic Chemistry attended National Food Conference on Agriculture and Technology Innovations for “Nutritional Security-NFC 2018” held on 9-10th February, 2018 at Centre of Food Technology, University of Allahabad, U.P. & presented a poster on “Alternative Sweeteners as sugar substitute: incentive, influence & innovation”.

5. One day meet on Ethanol Production and Incineration boiler based co-generation units in molasses based distilleries organized jointly by NSI and Cogen India on 15th March, 2018 at Lucknow. Shri J. P. Srivastava presented a paper on "Indian Molasses based Distillery: Ethanol & Power Export Potential" during the conference.



6. Prof. Narendra Mohan, Director and Shri D. Swain, Prof. Sugar Engineering attended the IAPSIT-2018 held at Udon Thani, Thailand from 6-9th March, 2018. Director, NSI delivered a key note address on “Green Energy from Sugar Industry” during the conference. Two more papers were presented during the conference.



7. Prof. Narendra Mohan, Director, upon invitation, visited Sugar Research Institute, Ahvaz, Iran. Discussions were held with Sugar Research Institute officials for collaborative research work and development of the Sugar Research Institute at Iran. He also visited few factories to have a first look into the technical efficiencies of the plants for improvement.



8. Dr. Vishnu Prabhakar Srivastava, Asstt. Professor Organic Chemistry attended a short course at IIT, Kanpur of duration 6 days from February 26 to March 03, 2018 on "Re-inventing fly ash into near-whitened material for generating white polymer composites: Technological Advancements" as a part of "Global Initiative of Academic Network (GIAN) Course, sponsored by MHRD India and AICTE.

➤ DISTINGUISHED VISITORS:

1.Mr. Kitti Choonhawong, President, Thailand Society of Sugarcane Technologists, visited the institute and had a look various laboratories and other facilities of the institute. He took keen interest in research work aspired for a possible tie up for conducting collaborative research work.



2. Dr. Mahendra Prasad, Former Director, NSI Kanpur visited the institute on 21th March, 2018. He visited institute's various laboratories and many useful tips were given by him for conducting R&D work on some unexplored areas.



3. Dr. A Salim Sajid, Ex. Chemical Engineer delivered a very interactive & useful lecture for the benefit of the students on 19th January 2018, where the students got a chance to learn many practical aspects of various unit operations in a sugar factory.



4. The participants of International Conference Agricon-2018 visited the institute on 15th February, 2018. They visited various laboratories, Nano Brewery, Nano Ethanol unit and Experimental Sugar Factory etc. They were also apprised about the various teaching programmes conducted by the institute & also on areas of research.



5. Shri Devendra Singh "Bhole" Hon'ble Member of Parliament from Akbarpur constituency and Shri Arun Pathak, MLC visited the institute on 1st March, 2018. They visited many newly developed facilities viz. Analytical Laboratory & Ethanol Laboratory at the institute and expressed their great satisfaction over the facilities being developed and work carried out for the betterment of sugar, ethanol & allied industries.



➤ NEW YEAR CELEBRATED:

New Year get-together function was organized at the institute on 7th January, 2018. Many distinguished alumni also graced the occasion.



➤ REPUBLIC DAY:

The Institute celebrated 69th Republic Day on 26th January, 2018. On this occasion, Prof Narendra Mohan, Director hoisted the National Flag and took the salute from the security guards. He called upon the staff and students to work together in making NSI, a clean and green campus. Discipline, dedication and attitude, these are three key factors for achieving success in life, he added. On the occasion, winners of various competition held during Swacchta & Hindi Pakhwada were also awarded.



➤ EXPERIMENTAL SUGAR FACTORY:

“Boiler Pooja” performed, on 24th January, 2018 with firing of boiler and Mill Pooja performed on 29th January, 2018 for the crushing season 2017-18 at ESF. Crushing operations of the Experimental Sugar Factory closed on 9th March, 2018.



➤ PREPARATION & SALE OF SUGAR STANDARD GRADES:

To facilitate grading and marketing of Plantation White Sugar, Bureau of Sugar Standards issued 131 Sugar Standard Grades to 23 Sugar factories during the period January-March 2018.



➤ SWACHHTA PAKHWADA:

“Swachhta Pakhwada” was organized from 16th to 28th February, 2018. During the Swachhta Pakhwada various activities such as Drawing Competition, Nukkad Natak, Essay & Poem competition etc. were organized in which staff and students enthusiastically participated. A massive cleanliness drive was also carried out in the administrative building, residential buildings and student hostels.



➤ हिन्दी कार्यशाला:

सरकारी कामकाज में राजभाषा के रूप में हिन्दी के प्रति जागरूकता लाने तथा उसके उत्तरोत्तर विकास हेतु संस्थान में 16मार्च 2018 ,को हिन्दी कार्यशाला का आयोजन किया गया जिसमें संस्थान ,के निदेशक ने सभी विभागाध्यक्षों को निदेशित किया कि सभी अपने अधीनस्थ कर्मचारियों को हिन्दी में कार्य करने को प्रेरित करें जिससे कि राजभाषा विभाग के निर्देश का पालन सुनिश्चित किया जा सके। कार्यशाला में राजभाषा में कार्य करने से सम्बंधित मुख्य बिन्दुओं पर भी प्रकाश डाला गया ।



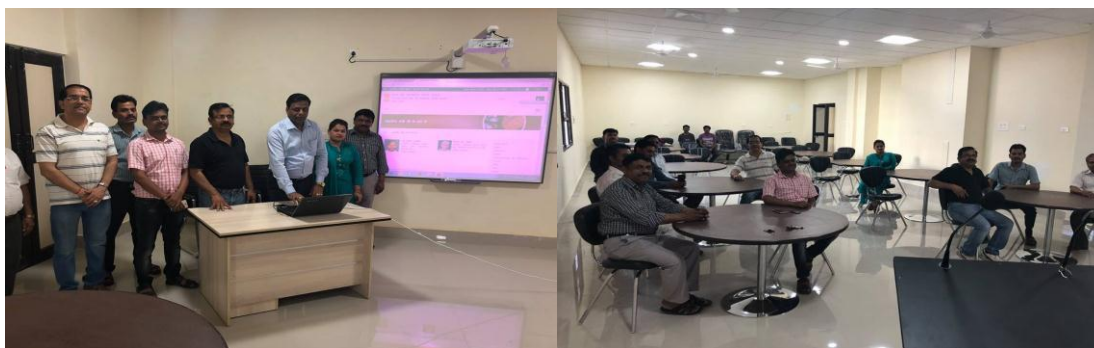
➤ INDUSTRIAL VISIT:

Students of “Pradhan Mantri Kaushal Kendra” (PMKK) Skill Development Centre, Kanpur visited institute on 22nd March, 2018. They visited various laboratories, Nano brewery, Nano Ethanol Unit and Experimental Sugar Factory situated in the institute. Information regarding courses conducted by the institute and job prospects was given to the students.



➤ WI-FI CAMPUS:

Institute campus has been converted into a Wi-Fi campus now. The facility has been developed for the entire academic area, institute hostels, Experimental Sugar Factory and other places where it is essentially required.



➤ OUR ADVISORY:

Besides conducting teaching and training programmes, carrying out research in relevant field, another main function of the institute is:

1. To function as a “Think-tank” to sugar and allied industry for proposing modernization and trouble free functioning of the process on advisory basis / through Extension Services.
2. To formulate strategies and promotes measures for expansion of capacities, energy conservation, co-product utilization etc. for sugar and allied industries.
3. To assist Govt. of India through technical contribution in policy formulation and control of Sugar Industry.

➤ CONSULTANCY SERVICES:

During the period January-March, 2018 consultancy services were provided to the following:

1.	M/s Tikaula Sugar Mills Ltd., Distt- Muzaffarnagar, U.P.
2.	M/s Dwarikesh Sugar Industries Ltd., Dwarikeshpuram, Bundki, Distt- Bijnor, U.P.
3.	M/s Dwarikesh Sugar Industries Ltd., Dwarikeshnagar, Bundki, Distt- Bijnor, U.P.
4.	M/s Dalmia Bharat Sugar Industries Ltd., Unit-Nigohi, Distt-Shahjhanpur, U.P.
5.	M/s Uttam Sugar Mills Ltd., Libberheri, Distt-Haridwar, Uttarakhand.
6.	M/s Dhampur Sugar Mills, Dhampur, Distt- Bijnor, U.P.
7.	M/s K.M. Sugar Mills Ltd., Motinagar, Faizabad, U.P.
8.	M/s Uttam Sugar Mills Ltd., Barkatpur, Distt- Bijnor, U.P.
9.	M/s L.H. Sugar Factories Pvt. Ltd., Saukara, Distt- Pilibhit, U.P.
10.	M/s Tikaula Distillery, Distt- Muzaffarnagar, U.P.
11.	M/s Saraiya Sugar Mills Ltd. Sardarnagar, Gorakhpur, U.P.
12.	M/s Lord Distillery Ltd., Shadiabad, Ghazipur, U.P.
13.	M/s Rai Bahadur Narain Singh Sugar Mills Ltd., Laksar, Distt- Haridwar, Uttarakhand.
14.	M/s R. B. N. S. Distillery, Laksar, Distt- Haridwar, Uttarakhand.
15.	M/s Triveni Engineering & Industries Ltd., Unit-Sabitgarh, Distt- Bulandshahr, U.P.
16.	M/s Hari Nagar Sugar Mills Ltd., West Champaran, Bihar.

17.	M/s Dalmia Bharat Sugar Industries Ltd., Unit-Nigohi, Distt-Shahjhanpur, U.P.
18.	M/s Wave Industries Pvt. Ltd., unit- Bijnor, Distt- Bijnor, U.P.
19.	M/s Wave Industries Pvt. Ltd., unit- Dhanaura Mandi, Distt- Amroha , U.P.
20.	M/s Wave Industries Pvt. Ltd., unit- Bulandshahar, Distt- Bulandshahar, U.P.
21.	M/s PBS Food Pvt. Ltd., unit- Chandpur, Distt- Bijnor, U.P.
22.	M/s Dewan Sugar Ltd., Distt- Moradabad, U.P.
23.	M/s Shamli Distillery & Chemical works, Unit of Sir Shadilal, Distt- Shamli, U.P.
24.	M/s Neoli Sugar Factory, Distt- Kasganj, U.P.
25.	M/s Sonipat Co-operative Sugar Mills Ltd., Sonipat, Haryana.
26.	M/s Triveni Engg. & Industries Ltd., Sugar, Unit- Milaknarayan, Distt- Rampur,U.P.
27.	M/s Rudra- Bilas KSCM Ltd., Bilaspur, Rampur, U.P.
28.	M/s Nanglamal Sugar Complex ,Distillery Division, unit of Mawana Sugars Ltd., Distt- Meerut, U.P.
29.	M/s Nanglamal Sugar Complex, unit of Mawana Sugars Ltd., Distt- Meerut, U.P.
30.	M/s Balrampur Chini Mills Ltd., Unit- Balrampur Distillery, Distt- Balrampur, U.P.
31.	M/s The Kisan Sahkari Chini Mills Sathion, Distt- Azamgarh, U.P.
32.	M/s Dalmia Chini Mills Ltd., Jawahapur, Ramkote, Distt- Sitapur, U.P.
33.	M/s Dhampur Sugar Mills Ltd., Asmoli, Distt- Sambhal, U.P.
34.	M/s Dalmia Bharat Sugar Industries Ltd., Nigohi, Distt- Hardoi, U.P.
35.	M/s Dalmia Bharat Sugar Industries Ltd., Ramgarh, Distt- Sitapur, U.P.
36.	M/s PBS Food Pvt., Ltd., Chandpur, Distt- Bijnor, U.P.
37.	M/s Wave Industries Pvt., Ltd., Unit- Saharanpur, U.P.
38.	M/s Wave Industries Pvt., Ltd., Unit- Bijnor, U.P.
39.	M/s Wave Industries Pvt., Ltd., Unit- Bulandshahr, U.P.
40.	M/s Wave Industries Pvt., Ltd., Unit- Amroha, U.P.
41.	M/s Balrampur Chini Mills Ltd., Unit- Babhnan Distillery, Distt- Gonda, U.P.
42.	M/s Dhampur Sugar Mills Ltd., Unit- Dhampur, Distt- Bijnor, U.P.
43.	M/s Triveni Engineering & Industries Ltd., Chandanpur, Distt- J.P. Nagar, U.P.

➤ ANALYTICAL SERVICES:

The institute now has a Centralized NABL Accredited Analytical Laboratory to carryout analysis of sugar, molasses, alcohol and other related products as ICUMSA and other standards protocol. During the period, analytical services were rendered to following:

1.	M/s Shrivasti Kisan Sahkari Chini Mills Ltd., Nanpara, Distt- Bahraich, U.P.
2.	M/s The Kisan Sahkari Chini Mills Ltd., Shahjahanpur, U.P.
3.	M/s The Kisan Sahkari Chini Mills Ltd., Sathiaon, Distt- Azamgarh, U.P
4.	M/s Daurala Sugar Works, Daurala, Distt- Meerut, U.P.
5.	M/s The Kisan Sahkari Chini Mills Ltd., Nazibabad, Bijnor, U.P.
6.	M/s The Nawanshahar Co-operative Sugar Mills Ltd., Nawanshahar, Distt- Shahid Bhagat Singh Nagar, Punjab.
7.	M/s Uttam Sugar Mills Ltd., unit- Barkatpur, U.P.
8.	M/s The Kisan Sahkari Chini Mills Ltd.,Tilhar, Shahjahanpur, U.P.
9.	M/s Rai Bahadur Narain Singh Sugar Mills Ltd., Laksar, Uttarakhand
10.	M/s The Kisan Sahkari Chini Mills Ltd., Kaimganj, Farrukhabad, U.P.
11.	M/s Shanti Sugar Industries, Kareem Nagar, Distt- Bijnor, U.P.
12.	M/s Rajasthan State Ganganagar Sugar Mills Ltd., Rajasthan.
13.	M/s Harinagar Sugar Mills Ltd., Harinagar, West-Champaran, Bihar.
14.	M/s Uttam Sugar Mills Ltd., Unit-Shermau, Distt- Saharanpur, U.P.
15.	M/s Seksaria Biswan Sugar Factory Ltd., Distt- Sitapur, U.P.
16.	M/s Balrampur Chini Mills Ltd., Unit- Haidergarh, Distt- Barabanki, U.P.
17.	M/s The Shahabad Co-operative Sugar Mills Ltd., Shahabad, Distt- Kurukshetra, Haryana.
18.	M/s Uttam Sugar Mills Ltd., Unit-Barkatpur, Distt- Bijnor, U.P.



RESEARCH ARTICLE:

“A REVIEW ON SPECIALITY SUGAR MANUFACTURING IN INDIAN SUGAR FACTORIES”

by

S. K. Trivedi & Vivek Pratap Singh
National Sugar Institute, Kanpur, India

ABSTRACT:

The sugar cane production and sugar manufacturing industry plays a major role in Indian economy. The progress of Rural India is more or less related to progress of sugar mills. The present increase in stocks of sugar worldwide leads to reduction in sugar prices. This is also impact on Indian Sugar industry. To overcome this, further research and development, increase in productivity with better quality sugar and production of speciality sugar is the better alternatives.

INTRODUCTION:

Sugar is becoming a sensitive issue in world economics as well as politics. A major problem is unstable world market price for sugar and policies of developed and developing nation makes both trading and production riskier. Since last few decades the sugar industry worldwide is passing through critical stage of surplus stocks. This is might be due to surplus production as compared to the consumption of sugar. The production of speciality sugars will involve the development of new skills in taste, texture and colour. This is required by the manufacturing team of Indian Sugar Industry in order to be able to make consistent high quality products and to be able to adapt the products to meet the requirements of marketing. The marketing of these products more of a challenge than the manufacture and so it is recommended that a development of kitchen is established in metro cities. This will allow the production of products that match Indian, taste rather than matching what has been sold in Europe. Since the Indian Sugar Industry tried to enter the top end market, Quality is of prime importance. Shelf life Tests for all products need to be established as soon as possible so confidence is gained that there will be no unexpected deterioration over time and no customer complaints will be received production is started.

RANGE OF SPECIALITY SUGARS:

Following table shows the range of Speciality Sugars 1 for market requirement as per demand from premium /Institutional buyers i.e for HoReCa means Hotel Restaurant & cafe.

S.No	Category	Specialties Sugar
1	Refined	Breakfast Sugar Extra Fine or Vending Sugar Caster Sugar Golden Caster Sugar Jam Sugar
2	Cubes	White cubes Demerara Cubes Rough Cut white cubes Rough Cut Demerara cubes
3	Icing	Fondant Icing
4	Brown Crystal	Demerara Sugar Golden Crystal
5	Soft Browns	Golden Soft brown Light Soft Brown Dark Soft Brown
6	Invert Syrups	Acid Light Invert Acid Medium Invert Acid Golden Invert Enzyme Light Invert Enzyme Medium Invert Enzyme Golden Invert

REFINED SUGAR:

The refined Sugar generally consists of small grain sugars produced for certain duties in tight size ranges. These small grains in the size range 300 to 600 micron can be produced directly by boiling to size specification in the crystallising pan, but for Indian Sugar the better way to prepare these sugars is by sieving. Discussion during the visit of Khatauli Sugar Mill, a Unit of Triveni Engg . Ltd that the initial sugar for products would be sieved out of SS refined sugar that has been bagged in 50Kg sacks when the refinery is operating in S/SS mode rather than L/M/S. Providing enough time had elapsed between

the sugar being bagged and then removed for sieving, there should be no risk of sugar caking in the 0.5 Kg or 1 Kg bag that the Retail Sugar packed in.

There are two facts to base the length of the time the sugar should be kept in the 50Kg bag before it is used for Speciality Production. The first is that it would be expected that all the moisture present as a syrup layer on the sugar crystals would be converted into crystal and free water within the 48 to 72 hours after being bagged. The second is that the liberated moisture in the sugar continues to migrate back and forth to give gradually increasing levels of caking for 15 days after bagging.

It would be expected that the action of removing the sugar from the bag and then subjecting it to sieving would provide enough air movement to take all of the free moisture away from the sugar.

Sugar and water is always be in equilibrium with each other and below 65 % Relative humidity; the equilibrium moisture content of sugar will be low. Above 65 %, the equilibrium moisture content will start to rise rapidly as the Relative Humidity increases.

So as long as the sugar is repacked in an environment that is less than 65% Relative Humidity then the act of sieving 72 hours after bagging should be good enough to guarantee that the residual moisture content of the sugar is low enough to ensure there is no caking in the retail pack.

If the amount of caking in SS sugar stored in 50Kg sacks is only soft caking and it will all be broken up by the act of sieving, then it would be better to leave the SS sugar in sacks for 15 days and then use it for trial production runs sample for marketing.

SHELF LIFE TESTS OF REFINED SUGAR:

One of the main areas will be to find out about maintaining properties of sugar once it is in the final retail packs. This would be to look for microbial spoilage in cubes and soft brown sugars, visual hazes and microbial spoilage² in invert syrup and caking in these small grain sugars.

It might be possible to devise the tests in a temperature controlled cabinet with changing day and night temperatures to simulate moisture migration but the easiest way testing is just storage trials for the periods that it is anticipated that sugar will be in the bag before it is used. Since this might be periods of 6 to 12 months, then the sooner these trials are started then the sooner confidence will be gained in the quality of the product.

The driving force for caking will be the variation in day and night temperatures⁴. It is necessary to locate the refined Sugar storage trials in an area similar to the finished goods warehouse so that the variation in day and night temperature will be similar to the conditions that the production runs of sugar will experience. The sugar will be packed in

paper bags which in turn will be placed in cartons and cartons put into cases containing a number such as 24 cartons . It is important that the sugar is stored in this final packing configuration since the ones on the outer edge of the case may react differently to the ones in the middle of the case.

The frequency of the checking and the method of checking needs be agreed if for example, the sugar is to be checked every month for 12 months, and the testing involved the opening every and checking for caking 5, this would involve at least 12 cases of sugar to be produced for storage trails . It might be better to take the worst case of storing single cartons, where the temperature variations will have a greater effect on caking and prove that those are not affected. Then the full cases should be much less likely to be a problem.

REFINED SUGAR CUBES:

Cube sugar has a long history. Originally refined sugar was sold in the 1800s as a sugar Loaf made from Refined Massecuite put in a conical mould and the liquor was allowed to drain out. The loaf was then broken up into smaller pieces with special cutting tools for use in hot drinks such as tea.

In order to replace the sugar loaf with readymade pieces of sugar, processes were developed in the late 1800s to adapt the sugar loaf process into an Industrial method for making cubes. In 1894, Thames refinery replaced the Langen Cube Process with the Adant Cube process and were able to reduce labour force. The Adant process used a very low colour Massecuite to produce the cubes. The massecuite was specially grown to give a mixture of large and small crystal, the large crystal to give shine and small crystal to fill the spaces between the large crystals. The massecuite was poured into large moulds to give slabs approximately 400mm X 200mm X 17mm and these were built up in a circular framework. This frame work was then spun as a centrifuge and washed with high purity syrup. The slabs were then removed from the frame and then passed through an oven for drying . The slabs were then cut into required size , which could be varied according to the requirements . The final products was unsurpassed in whiteness and ease of dissolving.

The Pressed Sugar Cube made by moistening the sugar crystals ,compressing and drying was regarded as far inferior product. Compared to the Adant Cube, the pressed cube was regarded as having a dead appearance with little sparkle and the hard sides belief a somewhat soft interior. The pressed cubes were produced by adding the moistened sugar into square recesses called 'sockets' on the periphery of a brass drum . Inside the drum is a mechanism that actuates square plungers that press the sugar into small cubes and then discharge them onto a tray for passing onto oven for drying .Since each cube is separate , then drying is a lot easier than the slabs from the Advant Cubes .

The above description of the pressed Sugar Cube dates from 1940s or 1950s and represents the simplest method of making cubes and is still the preferred method today. Cubes machine are available with drums with multiple rows capable of production rates of up to 2500 kilograms per hour. The best known manufacture is Elba from Holland but their machines are very expensive and many copies are available from India and around the world.

THE SECRET OF GOOD CUBES:

The sugar coming out of the cube making machine is very fragile .It is not until comes out of the drying conveyor that it achieved a reasonable level of strength. However it will not achieve its final strength until the remaining moisture has left the cube. Hence there has to be a period when the array of cubes in the paper wrapper is allowed to dry further prior to being packed into carton and cases there is possibility that the cubes will disintegrate into soggy mush.

So the ideal cube has to have the right initial moisture content going into cube making machine and then the right conditions of heat in the drying conveyor and final drying once wrapped. The only way to achieve the ideal cube is to measure the initial moisture content the moisture content after drying and air drying and relating these readings to the strength of the cubes on compression tester.

Right combination of water quantity addition and drying that the right strength of cube will be obtained. It can be appreciated that higher water addition will dissolve more sugar from surface of crystals and allow more caking bonds to be created resulting in a stronger cube. However if the moisture cannot be removed easily in drying conveyor and by air drying for a reasonable time , then end result will be a weak cube .

Hence the wrapped cubes need to be left in an area with a forced air flow and left in a way with large air gaps between the packs to allow the moisture to leave the wrapped packs. The moisture content of the sugar would be measured. This would be convenient to be done with the electronic moisture balance. Once it is at a low enough level and the required strength on compression tester has been obtained, then the wraps can be transferred into the cardboard boxes and cases. This may take 2-3 days to achieve the required moisture content with the possibility of reducing the time by use of heated air flow.

This strength issue is another reason for setting up shelf life testing to ensure this product will maintain the required hardness. It is important that before the cubes go to the market, that factory have the confidence in the product that it will not deteriorate in storage.

DEMERARA SUGAR CUBES:

Demerara Sugar cubes are also produced in some factories in India & worldwide. These cubes will be produced from demerara sugar made for brown crystal specialty range. In Europe the Demerara sugar cubes would be used for sweetening coffee (but not tea) and so a taste that compliments the coffee should be found.

ROUGH CUT CUBES:

Rough cut cubes are made in two different ways:

The first method, take ordinary perfect cubes and add them to a tumbling machine and the straight edges broken off. This relies on the cubes initial high strength , as measured by the compression tester so that they do not disintegrate completely when being tumbled . It is likely that the initial cube used for this method is larger than the cubes produced normally. This method is no longer used by the bulk producer of rough cut cubes and they moved to the next method which produces much more attractive product .

In the second method still produces the cubes by putting a sugar and water mixture in trays with a sugar height of 17-18 mm .The trays are left to harden and once they have reached a sufficient strength they are taken out of the tray and then cleaved with knife to produce the rough cut edges .The cubes are then to air dry completely to achieve the final strength and then packed into 500 /1000 gram plastic bags ,heat sealed and then added to cartons .

The final product is a strong cube so the drying time once they have been broken up into the rough cubes must be fairly long . It is known at this time if it is speeded up by the use of fans of hot air and whether the loose cubes are left in perforated trays to allow a good air-flow.

ICING SUGAR:

The milling of Granulated sugar into icing sugar is a well-established process all over the world, it is also called as confectioners' sugar or icing sugar, it is very fine sugar which contains a small amount of anti-caking agent. Icing Sugar has been used in the food, baking and confectionary industries for a long time. Production of icing sugar or milled sugar was an industry art and was known to but a few master confectioners. The process was not only to include the actual grinding mill but the safety system to stop an explosion occurring and also a system to mix an anti-caking agent in to the sugar. In this paper the authors have explained are explain the concept of Milled Sugar or Icing sugar manufacturing in Indian Sugar Industry as a speciality sugar along with the specification's, scope, packaging techniques, their shelf life, their use in Indian kitchen, along with the scope of marketing in Super markets

S.No	Parameter	Indian Standard	Finest Icing Sugar	Tate & Lyle Icing Sugar	Fondant Icing Sugar	Powdered Sugar
1	Appearance	Brilliant White ,Fine powder	Brilliant White ,Fine powder	White ,fine powder	Fine powder	milled sugar ,fine crystals
2	Moisture %	Not more than 0.80 %	NA	NA	NA	NA
3	Reducing Sugar %	Not more than 0.06	0.04	0.04		0.04
4	Odour	No off - Odour	Odourless	Odourless	Odourless	Odourless
5	Taste	Typically sweet & with no off taste	Sweet	Sweet	Sweet	Sweet
6	Grain Retention %	Not less than 2 % on 0.150 mm standard test seive	<0.5% on 0.146 mm, <5% on 0.102 mm, <17% on 0.60 mm cum	<0.5% on 0.146 mm, <5% on 0.102 mm, <17% on 0.60 mm cum	<0.5% on 0.146 mm, <5% on 0.102 mm, <17% on 0.60 mm cum	<10% on 0.21mm, <16%- 25% on 0.60 mm cum
7	Anti-Caking Agent (Starch)	Max 5 %	Not Present	Anti-caking agent upto 11%	Finally milled sugar&5-6% glucose solids	Not present

Other specification of Icing Sugar as per samples available in Market are as follows:

1	Solution colour Range	50 IU	30 IU	30 IU		30 IU
2	Sulphur Dioxide (ppm)	Not more than 10 ppm	1	1	1	1
3	Lead (ppm)	Not more than 5				
4	Arsenic (ppm)	Not more than 1.1				
5	Microbiological : Aerobic Mesophilic Bacteria	Less than 500 cfu per gram				
6	Yeast	Less than 10 cfu per gram				
7	Mold	Less than 10 cfu per gram				

The bakers use icing sugar to eliminate all perceptions of grittiness normally associated with standard granulated sugar. The grittiness in granulated sugar is due to large particle size, greater than 50 μm . It is commonly accepted that sugar smaller than 50 μm in size is considered as Icing sugar. The icing sugar is prepared by co-milling a sugar with a low -DE (Low Dextrose equivalent) cereal solid. Because of the inclusion of low -DE material, the icing sugar wets out faster, retains and holds moisture, and will not separate or settle out upon storage as do other powdered sugar. This product makes smooth creamy -texture icing and high quality doughnut glaze with superior adherence and sheen. The main areas of application are butter cream icing, fruit icing, fudge icing, bakery glazes, pour icings and doughnut dustings.

Like all fine powders, icing sugars has very different flow characteristics from normal coarse powders. One moment it can flow like water and the next vertical wall of product that does not want to flow, this means either storage, conveying and packing systems have to be kept simple or very sophisticated designed equipment has to be used.

The icing sugar vary in specification around the world and can range from standard icing sugar with an average particle size of around 20 μm to powdered sugar which may average 50 μm size. A laser size analyser gives a very accurate size distribution as compared to sieve analysis test.

ICING SUGAR SPECIFICATION:

There are two major ways of measuring the size of Icing Sugar. One with sieves and the other is with laser size analysis. The laser size analyser is the ideal instrument since it gives a detailed analysis of the particle size distribution and is an ideal tool to maintain the icing sugar specification .

Since the icing sugar will be generally of 20-25 μm average particle size, it is very hard to obtain any kind of accurate size analysis by using the sieves. The smaller mesh sieves down to less than 100 μ aperture can be purchased but it is very hard to get a consistent value, so only limited size distribution information can be obtained by using sieves.

It is important in icing sugar production that there are no large particles present that would give the formulations a gritty feel.

ICING SUGAR SPECIFICATIONS3: As per IS 1152-1976 the Icing Sugar Specifications (Indian Standard) and other specifications of Icing Sugars (Available in International Market) are as under:

SHELF LIFE TEST AND PACKING MATERIALS FOR ICING SUGAR:

Icing Sugar with anti-caking additive should have a shelf life⁶, Maximum up to 6 months, as per the average analysis results of different samples collected from local market shown in Table 1. It is essential to maintain the property of icing sugar once it is packed in the final

retail or institutional pack .This would be look for microbiological spoilage and caking in this small grain size icing sugar .The driving force for the caking will be variation in day and night temperatures, it is necessary to locate the icing sugar trails in the areas similar to the finished goods ware house so that variation in day and night temperature will be similar to the conditions that the production runs .

It has been found that it is better to use a paper with an impervious layer in it to stop moisture migration of from outside atmosphere risking spoiling the icing sugar. It is also suggested that icing sugar retail/institutional bag made up of two layers of paper, the inner paper has a polythene layer on the outside of the bag so that icing sugar is in contact with paper. It is also possible to pack icing sugar with a form full and seal machine using laminate bag.

SHELF TEST : ICING SUGAR

S.No	Icing Sugar (3% starch)Sample	Appearance	Solution colour (IU)	Odour	Taste	Reducing Sugar %	Grain Retention %	Moisture %
1	New packing	Brilliant	34 IU	Oudour less	Sweet ,No-off taste	0.03%	less than 1% on 150 µm	0.05%
2	1 month old	Brilliant	45 IU	Oudour less	Sweet ,No-off taste	0.03%	less than 1% on 150 µm	0.06%
3	2 month old	Brilliant	47 IU	Oudour less	Sweet ,No-off taste	0.03%	less than 1% on 150 µm	0.06%
4	3 month old	Brilliant	50 IU	Oudour less	Sweet ,No-off taste	0.04%	less than 1% on 150 µm	0.07%
5	4 month old	Slight fade	55 IU	Oudour less	Sweet ,No-off taste	0.04%	less than 1% on 150 µm	0.07%
6	6 month old	Slightly Dull	60 IU	Oudour less	Sweet ,No-off taste	0.04%	less than 1% on 150 µm	0.07%
7	12 month old	Dull	65 IU	Foul oudour	Sweet ,No-off taste	0.04%	less than 1% on 150 µm	0.08%
8	18 month old	Dull	80 IU	Foul oudour	Sweet ,off taste	0.04%	less than 1% on 150 µm	1.50%

BROWN CRYSTAL:

In most markets in the world, this range of products is familiar to most consumers since it would be the raw sugar produced in their sugar factories and may be readily available as their normal sugar for purchase. India produces its local sugar as plantation white and so does not have traditional for using these Brown crystalline Products.

The most common products are Demerara Sugar, originally produced in Demerara region of Guyana, Central America but it is now a generic name for golden brown sugar with a large regular crystal. In recent years another product has appeared on market called Golden grain which would be yellow in colour with a smaller crystal size than Demerara. These products are often marketed as being healthier option compared to refined sugar and are often sold under the fair trade banner. These Brown crystalline Products are would appear to provide and ideal product for offering into market as higher value item.

Since there is very few firms in India for these sugars, it then comes down to deciding what would be the Ideal specification? As per the products available in the market the like mawana select (Mawana Sugars) , Sunhera (Simbhaoli Sugars) and others the specification around 6000 IU colour and a crystal size just over 0.6 mm in Mean Aperture .

The Demerara Raws and Golden Crystal Sugars are usually produced in a sugar factory and then exported in 50 Kg sacks for repacking of into retail packs in the other place of use. These high colour Raw Sugar of 3000 – 4500 IU colour used for Demerara are often same as the Raw Sugar Produced for export and so minor change in production terms.

MOISTURE, IMPURITIES AND PRODUCTION OF BROWN SUGAR:

All of these crystals will be sold as free flowing crystal so the sugar needs to be dried and the moisture content checked. The industrial level production of brown crystal type sugar is a straightforward operation but it is likely to be expensive to produce a sugar that meets the required quality standard for items like insoluble particulate contamination.

The crystal could be produced in one of the refinery pans but the chance of cross contamination of the refined sugar product looks to be too big risk. A batch Pan in Raw sugar factory area would be better, especially since likely to feed syrups would be available but bringing the Factory area up to the required quality standard would be the big issue.

Ultimately this is the biggest issue for the production of these sugars. The main issue for the production of sugar from batch pan with in the factory will be the contamination of the sugar with a insoluble impurities. This will mainly be bagasse and iron oxide (rust) but it could be any other rubbish that is present around the factory.

SOFT BROWNS:

Soft brown sugars are appreciated for the special flavours that they will bring to make baked products. They are specially appreciated by sugar refiners as a way of reducing the load on Recovery. While at the same time selling a low grade product at a premium price.

CONCLUSION:

Scope and demand of Specialities Sugar is increasing day by day in Indian Super or Hyper market in retail and in bulk packing by the institutional buyers. The process technology is indigenously available and easier. This can be a tool for creating value addition but shall require proper processing & maintenance of hygienic conditions.

ACKNOWLEDGMENT:

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➤ **HAPPENING IN THE SUGAR INDUSTRY:**

Maharashtra's sugar sector faces tough competition from Uttar Pradesh.

Sugar millers from Maharashtra, already bogged down by falling demand and price, now have to reckon with sugar from Uttar Pradesh. Thanks to the logistical advantage, sugar from the northern state is fast posing a challenge even in the traditional markets which were monopolised by Maharashtra's sugar sector.

Sugar firm executives, 4 others booked for Rs 82 crore fraud.

Central Bureau of Investigation (CBI) sleuths registered a cheating case against two executives of NCS Sugars Ltd and four officials of Central Warehousing Corporation (CWC) for defrauding Project and Equipment Corporation Ltd (PEC) for Rs 82.11 crore.

Sugar export: Indonesia eyes possibility of importing raw sugar from India.

Indonesia, the world's second-largest sugar importer, is exploring the possibility of buying raw sugar from India, where a bumper cane crop has raised fears of a glut of the sweetener. India, too, is keen to export a bigger quantity, preferably through barter trade, according to industry executives.

Sugar prices fall on ample stocks, weak demand.

Sugar prices tumbled Rs 45 per quintal in the wholesale market today. Marketmen said huge stocks position on steady flow of arrivals from mills along with limited offtake by stockists and bulk consumers due to approaching month-end led to the fall in prices.

Indian Oil to start production of biomass-based ethanol.

Indian Oil Corporation: Indian Oil would initiate production of second generation ethanol by utilising crop residues and other biomass as feedstock at village Baoli in Panipat district of Haryana.

Australia – Cane crop in the far north Queensland hit badly by flooding.

Over half of the 2018 cane crop in Queensland's Far North region between Townsville and Cairns has been adversely impacted by flooding, according to a survey by Australian sugarcane farmer's organization CANEGROWERS.

Uzbekistan – New US\$100 million beet sugar factory planned.

Construction of a new beet sugar plant in the in the Tashkent region will commence in the near future, according to local press reports.

France – Record 2017/18 sugar beet output by Tereos.

The Tereos 2017/2018 beet campaign has set a new record in France, supported by forward planning and innovative initiatives along the value chain from agricultural production to processing.

Azerbaijan – Farmers incentivised with soft loans to grow sugar beet.

The National Entrepreneurship Support Fund (NFES) on March 15 signed a memorandum of understanding (MOU) with the Union of Sugar Producers of Azerbaijan and Azerbaijan Industrial Bank (ASB), overseen by the Azerbaijani Ministry of Economy, according to local press reports.

Thailand – Record 2017/18 sugar output of over 12 million tonnes forecast.

Following a survey with 11 traders and analysts, Bloomberg reports that the 2017/18 sugar output is likely to be a record of around 12.6 million tonnes – the responses were in the range 12 million to 13.6 million tonnes.

East Africa – Sugar refining opportunity abounds as demand for white sugar escalates.

Due to lack of sugar refining capacity in East Africa, food processors in the region are having to rely on imports of white sugar from outside the region and thereby, continue to lose millions of dollars to overseas markets, reported Uganda's paper Independent.

Fiji – EU funds US\$1.9 million to upgrade access roads to Rarawai mill.

Fifty-four cane access roads in the Koronubu sugarcane sector will soon be upgraded thanks to some US\$1.9 million partnership between the European Union and the Pacific Community (SPC) Rural Access Roads and Associated Infrastructure (RARAI) project.

Bajaj Hindusthan Sugar allots OCDs.

Under BHSL S4A Scheme Bajaj Hindusthan Sugar has allotted 1,38,99,376 Optionally Convertible Debentures (OCDs) of Face Value of Rs.100/- each at par to Corporation Bank on conversion of a portion of Part -B (Unsustainable Loan) in accordance with the BHSL S4A Scheme.

Drip irrigation system to be introduced for cane farmers in state.

In an attempt to double the income of farmers by 2022, Sugarcane department in Uttar Pradesh has decided to introduce drip irrigation system for cane farmers which will be liked with overhead tanks that would operate with solar pumps.

Karnataka gives highest sugarcane price: Minister.

Karnataka is giving the highest price for sugarcane, said small scale industries and sugar minister Geetha Mahadev Prasad here on Thursday. Speaking to reporters after inaugurating the residential training school, stem cell laboratory and soil test centre at S Nijalingappa Sugarcane Research Institute.

Sugar commissioner calculates interest for 3 mills.

Three sugar mills have failed to pay growers the fair and remunerative price (FRP) in the ongoing season, which has led the sugar commissioner to start the process of calculating interest on late payment.

Sugarcane association seeks reduction in sugar recovery percentage.

The Karnataka State Sugarcane Growers' Association has urged the Centre to reduce the desired level of sugar recovery percentage to 8.5 while prescribing the Fair and Remunerative Price (FRP) for sugarcane.

No 'sweet pongal' yet for TN sugarcane farmers.

Though almost all farmers in the country are suffering one way or the other, the nightmare of the sugarcane farmers in Tamil Nadu is even more.

New Zealand – Extensive review by a think tank slams sugar taxes.

A report commissioned under the previous National Government has debunked popular justification for sugar taxes. Its findings show only weak evidence a sugar tax has been effective at improving health outcomes in other countries.

USA withdrawal from NAFTA would attract tariff of 15¢/lb on Mexican sugar.

If President Donald Trump withdraws from the North American Free Trade Agreement (NAFTA), the US tariff on sugar imports from Mexico would revert to the 15 cents per pound level in place before NAFTA went into effect, Jason Hafemeister, trade adviser to Agriculture Secretary Sonny Perdue, told the delegates at the International Sweetener Colloquium event in Florida on February 15.

Malawi – Fortifying sugar with vitamin A drives Illovo's sales.

Illovo Sugar in Malawi, fortifying its white sugar with vitamin A helped drive sales in the recent past, according to the local paper Nyasa Times.

USA – United Sugars to market Wyoming Sugar’s products.

The beet sugar producer Wyoming Sugar Company and the marketing co-operative United Sugars Corp. have entered into an agreement under which United Sugars will sell Wyoming Sugar’s products.

Australia – Bundaberg Sugar embarks on producing organic sugar.

Bundaberg Sugar is to start producing organic raw sugar after achieving Australian Certified Organic (ACO) status. This is the first miller in the country to embark on this venture, according to local press reports.

Canada – Advanced Chemical Technologies to invest US\$120 mln in a methanol plant.

Advanced Chemical Technologies (AChT) recently announced that it plans to will build a CA\$150million (US\$120 mln) demonstration plant by 2020 at the Bluewater Energy Park in Chemical Valley which will produce green methanol from industrial carbon monoxide emissions and natural gas.

Kenya – Sugar imports triple over the past two years to one million tonnes.

Sugar imports into the country nearly tripled from 334,109 tonnes in 2016 to 989,619 tonnes according to a market report from the Sugar Directorate.

Sugar’s fall hits farmers and mills.

A 15 per cent fall in sugar prices over the past three months has puzzled millers and farmers alike and adversely affected both. While farmers' organisations have alleged that a section of traders is artificially causing prices to drop, millers in Maharashtra have limited sugar sales.

Government assures sugar companies to hike duty on cheap Pakistan imports: ISMA.

The government has assured that it would consider hiking import duty on sugar from the current 50 per cent to check any cheaper shipments from neighbouring Pakistan, the Indian Sugar Mills Association said today.

India has no plan now to raise import tax on sugar, government source says.

India has no immediate plan to raise import tax on sugar as the government does not see prospects of imports from Pakistan as of now, a senior government official said on Monday. Though the availability of sugar this year remains as tight as last year, India will have enough sugar.

Rashtriya Kisan Manch submits memorandum on sugarcane growers.

Office bearers of Rashtriya Kisan Manch today submitted a memorandum to the Sitapur district administration highlighting the hardships faced by sugarcane growers. "We have submitted a memorandum to the sub-divisional magistrate of Biswa tehsil in Sitapur district drawing his attention towards the hardships faced by the sugarcane farmers.

Kirlampudi sugar mill ordered to pay compensation to workers.

The Industrial Tribunal-cum-labour court at Visakhapatnam ordered payment of compensation ranging between Rs 50,000 and Rs 3 lakh to each worker of the closed Kirlampudi Sugar Mill depending on each worker's length of service.

Tanzania – Illovo Sugar plans to build a new sugar mill.

Illovo Sugar Africa through its subsidiary Kilombero Sugar is planning to build a new sugar mill in the Morogoro region, Tanzania where it has increased acreage of farms under its operation, according to local press reports.

Cuba struggling with sugar export commitments following hurricane Irma.

Hurricane Irma which hit Cuba last September caused extensive damage to cane, with some 300,000 ha affected, along with damage to some 40% of sugar mills. With harvest underway, the industry has had to cancel sugar exports in January as it is struggling to meet local demand, according to the head of the state sugar monopoly, reports Reuters.

Algeria – Beet sugar processing plant planned at a new refinery.

The Mazouz group will inaugurate its new sugar refinery with a capacity of one million tons per year on July 5, according to the CEO Ahmed Mazouz reported in the local press.

Sugar producers with preferential access make inroads into the Chinese market.

Smaller sugar producers in South America and Southeast Asia granted preferential access are taking advantage to export to China, reported Reuters.

Thailand – Local sugar price will be market-driven as policy overhauled.

Thailand's military government has eliminated control of domestic sugar prices and sales administration, the industry minister Minister Uttama Savanayana said on 16th January.

Taiwan – Imports of sugar from Nicaragua doubled to 60,000 tonnes.

Taiwan has increased the quota of sugar imported from Nicaragua to 60,000 tonnes following the Free Trade Agreement (FTA) that was concluded in Taipei in November 2017, according to press reports from both Taiwan and Nicaragua.

Japan – Mitsui Sugar invests US\$7.49 million to produce halal-compliant sugar.

Japan's largest sugar processor Mitsui Sugar will soon start refining sugar that complies with Islamic dietary law, according to the Nikkei Asian Review.

Iran – Self-sufficient in sugar production targeted by 2021.

Iran aims to be self-sufficient sugar production within three years, the deputy agriculture minister Abbas Keshavarz said, according to local press reports.

Govt may allot Rs 500 cr for sugar development fund in Budget.

The government may marginally raise the corpus for Sugar Development Fund (SDF) to Rs 500 crore in the upcoming Budget for 2018-19. SDF, managed by the food ministry, is used for lending money to mills at lower interest rates.

Crushing delayed, sugarcane grower sets crop on fire in Gadag district.

Upset over the delay on the part of a sugar factory in crushing sugarcane, a farmer in Kakur Tanda, Gadag district, set standing crops on his 2 acres of land on fire on Sunday. Prakash Abbigeri poured kerosene on his sugarcane crop and set it on fire. The farmer said that he grew the crop on 6 acres of land. "I will wait for 2-3 days. If the factory failed to visit my field (for crushing sugarcane), I will burn the remaining crop.

Green Pool signals caution on sugar prices.

Green Pool signalled further weakness ahead of sugar prices, lifting its forecasts for the world production surpluses this season and in 2018-19. The Australian-based analysis group said that sugar prices-which for New York raw sugar futures touched 12.25 cents a pound recently, the lowest for a spot contract since September 2015-had actually "held up remarkably well in the face of the surplus and addition to stocks".

A sugar shortage amidst glut.

Reduced availability of white sugar from Central America and the European Union on the market has pushed front-month sugar futures prices to a premium, despite a looming global supply glut.

Uganda: Sugar price to drop further.

Statistics from the Uganda Sugar Manufacturers Association (USMA), which consist of Kakira, Kinyara and SCOUL, shows that the industry projects to produce 388,000 tons of sugar this year, up from 326, 968 tons in 2017.

➤ ABSTRACTS:

Innovative methods to analyse and summarise mill data to identify some of the key factors impacting on farm productivity in the Herbert by J. Stringer, B. Croft, I. Asamoah, L. Di Bella, M. Sefton, R. Nielson, P. Larsen, R. De Lai & I. Davies published in International Sugar Journal January, 2018.

Production peaked in the Herbert River mills in 2005 but since then productivity has declined. Analysis of mill data in the Herbert has successfully identified groups of farming enterprises with similar productivity over time and the major factors associated with these groupings. Timing of all operations, including planting, weed and nutrient management and harvesting, engagement with industry organisations and fertile soils with high CEC, were important factors that discriminated the small-farm-size-low producing farming enterprises from the small-farm-size high producing farming enterprises.

Crop diversity in sugarcane: effect of mixed cultivars on the growth and yield of sugarcane by H. Takaragawa, K. Watanabe, J. Thanankorn, M. Nakabaru & Y. Kawamitsu published in International Sugar Journal January, 2018.

Sugarcane is usually grown as a monoculture over a large area of the world. Monoculture of crops such as sugarcane easily destroys the biodiversity of the farmland during cultivation. For sustainable agriculture, we have to consider the concept of biodiversity in

agriculture in terms of agro-biodiversity, agro-ecosystem and crop diversity. Recently mixing cultivars has been demonstrated to have potential as a new method to achieve high and stable yield in some crops. Mixing cultivars with different traits of tolerance to stresses or different growth rates creates cultural breaks in the field to prevent diseases and harmful insects from spreading and uses positive effects of competition and compensation between cultivars to increase growth and yield.

Sugarcane juice clarification by distillery fermenter gases by Narendra Mohan, A. Bajpai & M.P. Singh published in International Sugar Journal January, 2018.

In India and elsewhere many sugar factories employ the double sulphitation process of clarification for the production of plantation white sugar for direct consumption. Volatility in sulphur prices, growing demand for sulphur-free good quality sugar and health and environmental concerns prompted efforts to reduce or even eliminate the use of sulphur dioxide during the clarification process. With the objective to develop a greener techno-economic process which, besides eliminating sulphur, would also provide an opportunity to utilize CO₂ from distillery fermenters for producing sulphur less plantation white sugar, laboratory trials have been conducted with the juice from two factories.

The development of a screening tool to identify new products for the South African sugarcane industry by K.C. Booyesen, K.M. Foxon & S.B. Davis published in International Sugar Journal January, 2018.

The production of new revenue streams within the sugarcane industry would represent an opportunity to enhance economic stability and sustainability of the industry. However, identifying the most commercially feasible new product option from the numerous possibilities available is a challenge. The Sugar Milling Research Institute NPC developed the New Products Greenhouse (NPG) toolbox as a screening tool for generating a first-pass assessment of the commercial feasibility of new products. The NPG screening approach considers key aspects pertaining to the successful implementation of a bio-based product in a South African sugarcane biorefinery and integrates feedstock competition, market, technology and economic.

Strategies for increasing availability and milling performance at Colombian mills by D.F. Cobo, J.E. Lucuara, A.F. Ospina & J.D. Montes published in International Sugar Journal February, 2018.

Continuous operation of the sugar-energy industry in Colombia (322 days average for 2015) presents demanding technical challenges. CENICAÑA has an ongoing project on diagnosis for maintenance management for Colombian mills, looking for improvement opportunities. Cane reception and milling were confirmed as the most critical areas, using availability and maintainability indices. Equipment, including cane conveyors and preparation machines, were identified as critical in the reception area. In the crushing station, intermediate carriers and roller surface wear were the major determinants in the global performance index (OEE).

Six-roll mill with shaft mounted electro-mechanical drives by B. heron, P. delley, B. O'Brien & C. Garson published in International Sugar Journal February, 2018.

Mounting demands were being placed on the milling tandem at MSF Sugar Limited's South Johnstone Mill due to a combination of increasing crop size and rising cane fibre levels. Further rate increases were anticipated. An issue of particular concern with the existing tandem was the moisture of the final bagasse and its implications for extraction and boiler operations. South Johnstone chose to install a new, larger final mill as its initial response to this challenge. The new final mill was a six-roll, heavy duty pressure fed mill with rolls 2.55 m long and 1.36 m diameter.

Perforated mill roll shells by C. Garson published in International Sugar Journal February, 2018.

Perforated sugar mill roll shells contain a system of radial drainage passages connecting the surface of the roller to a set of longitudinal internal manifolds with open ends. The intention is that these perforated roll shells provide additional drainage paths for the juice extracted by the crushing mill. The claimed advantages of perforated rolls over solid rolls included improved mill feeding, increased extraction and reduced bagasse moisture. The paper reports previously unpublished trials undertaken in the 1990s with the aim of establishing the performance of perforated roll shells relative to that of conventional, solid roll shells when installed.

Effect of abiotic factors and leaf-quality of sugarcane on the seasonal occurrence of *Pyrilla perpusilla* Walker (Homoptera: Lophopidae) and *Epipyrops melanoleuca* Fletcher (Lepidoptera: Epipyropidae) by Muhammad Dildar Gogi, Muhammad Jalal Arif, Athar Mahmood, Umer Chatha & Sajawal Niaz published in International Sugar Journal March, 2018.

A study was carried out to determine the impact of abiotic factor and leaf-quality of sugarcane on the incidence of *Pyrilla perpusilla* and its parasitoid, *Epiricania melanoleuca*. Maximum numbers of eggs (23.95-34.85 eggs/leaf) and nymphs (8.4-12.7 nymphs/leaf) of *P. perpusilla* were recorded in July-August 2011, and adult numbers peaked in August-September 2011 (7.15 adults/leaf). Maximum numbers of eggs (222-246 eggs/leaf), larvae (5.9-6.3 larvae/leaf), pupae (4.9-5.4 pupae/leaf) and adults (1.04-1.25 adults/leaf) of *E. melanoleuca* were recorded in August, September and October 2011, respectively. Percentage parasitism peaked in October-2011 (43.2-56.7%).

Benchmarking cane supply quality in the Herbert, Burdekin, Proserpine and Plane Creek regions [in Australia] by P.L. Larsen, P.A. Patane & I. Asamoah published in International Sugar Journal March, 2018.

A survey of the quality of the cane delivered to the Herbert, Burdekin, Proserpine and Plane Creek regions was undertaken in 2015 to assess the quantity of extraneous matter (viz. dirt and roots, trash and tops) in the cane supply, as well as measure billet length and quality (viz. sound, damaged and mutilated).

Extraneous matter was between 5.4% and 32.7% of the cane supply in the Herbert, Proserpine and Plane Creek regions and between 3.6% and 12.0% of the cane supply in the Burdekin.

Effect of juice screen position on extraction by G.A. Kent & M. Doolan published in International Sugar Journal March, 2018.

For historical reasons and space considerations, the two rotary juice screens at South Johnstone mill are mounted over the #2 intercarrier that feeds #3 mill. Cush is deposited directly down into the intercarrier. As part of an investigation to identify opportunities to increase extraction, the option of diverting the cushion back to the #1 intercarrier that feeds #2 mill (the common approach in Australia) was considered. Recent modelling work, as well as encouraging advice from international technologists, suggested significant benefit in doing so.

How to use and interpret the results from a high performance liquid chromatography system at a sugarcane factory by Gillian Eggleston, David Stewart, Fernando Aponte, Belisario Montes, Stephanie Boone & Chardcie Verret published in International Sugar Journal March, 2018.

In 2015, a sugarcane factory established and operated the first High Performance Liquid Chromatography (HPLC) system in Louisiana. Although many HPLC systems exist, the factory opted for an ion chromatography (anion exchange) system with integrated pulsed amperometric detection. A gradient HPLC method was established to measure

mannitol, glucose, fructose, and sucrose in a run time of 10 min. For the best accuracy, separate and higher dilutions are needed to quantitate sucrose due to its considerably higher concentration in sugar products (except molasses).

Automation of white pans at the Tongaat Hulett refinery by F.S. Mncube, D.J. Love, P. Sikhakhane, D. Ogle & T. Mtembu published in International Sugar Journal March, 2018.

Pan boiling relies substantially on “art” rather than “science”, thus requiring skilled and experienced operators to optimise crystal sugar production. This puts heavy demands on staffing, training and skills transfer. Particularly in this context, automated pan boiling has the potential to provide substantial benefits in terms of plant capacity, process performance and product quality. Successful pan automation relies largely on the following aspects: instrumentation that reliably measures appropriate process parameters, a suitable control strategy that relies both on crystallisation fundamentals (science) and practical considerations (art), and control hardware that implements the strategy in a manner.

A Simple Approach for Rapid Screening of Sugarcane Genotypes against Wilt and Induction of Disease Resistance by B.H. Pawar, D.G. Patil & S.G. Dalvi published in STAI 2017.

Wilt incited by *Fusarium sacchari* is one of the serious diseases in sugarcane causing heavy losses in yield of sugarcane and sugar. Screening of varieties against wilt disease in field and its management through fungitoxicants have limitations in many ways.

Therefore, selection of disease resistant varieties and induction of systemic acquired resistance (SAR) in susceptible varieties against the disease holds the promise. The study was initiated under laboratory condition by using electrolyte leakage to develop a simple and rapid method for evaluation of genotypes against wilt disease and induction of disease resistance through chitosan. Evaluation of electrolyte leakage from plant tissue helps to diagnose susceptibility and resistance of genotypes to diseases under laboratory condition. Chitosan is a potential elicitor for induction of SAR to abiotic and biotic stresses in crops. In the present work, the elicitor from pathogenic fungus was extracted and used to treat leaf discs of different sugarcane genotypes to see its effect on electrolyte leakage. Later, the activation of defense enzymes in treated and nontreated leaf discs by chitosan was analyzed to confirm the SAR. Study reveals that, the *Fusarium* elicitor causes increased electrolyte leakage in susceptible varieties. It also reveals that chitosan treated sugarcane leaf discs showed the enhanced level of defense enzymes like peroxidases and phenoloxidases in susceptible varieties indicating the induction of disease resistance. Thus, chitosan can be used as a priming agent an elicitor for SAR in susceptible sugarcane. Thus, this laboratory technique will help in rapid screening of newly developed stock of varieties of sugarcane at early stage of development against wilt. This will also help to induce SAR in promising genotypes.

Advanced Cane Production Technologies for Enhancing Productivity and Quality of Sugarcane in Maharashtra State by A.V.

Solanke, D.H. Phalke & S.U. Deshmukh published in STAI 2017.

Sugarcane is the most important cash crop and plays a pivotal role in the rural economy of India and particularly in Maharashtra state. Sugar industry is the second largest agro based industry next to cotton in which higher investment is made. It has brought desirable changes in social economical and educational sphere in the country. Maharashtra is the leading state in sugarcane and sugar production in the country occupying second position next to Uttar Pradesh. Out of the total sugar production in the country, about 35 percent sugar is produced by Maharashtra alone. As far as the productivity is concerned the Maharashtra ranks third next to Tamilnadu and Karnataka with highest number of co-operative and private sugar factories. In general, the area under sugarcane in Maharashtra revolves around 10 Lakh hectares. However, the productivity which was more than 80 t ha⁻¹ before 2000-2001, has been declined drastically during 2001-02 to 2005-06 five years reaching to minimum level of 51t ha⁻¹ during 2003-2004 (Table-1). The major reasons for low productivity of sugarcane in Maharashtra were, inadequate rainfall resulting severe drought, sudden outbreak of sugarcane wooly aphid and also extended and excessive rains causing flood situation in major sugarcane growing districts in Maharashtra. Due to favorable climatic conditions from the year 2007-08 onwards the productivity was increased up to 87 t ha⁻¹ but again declined in the year 2013-14 to 82 t ha⁻¹ due to uneven rainfall pattern, incidence of disease viz. rust, brown spot and outbreak of root borer, white grub, internode borer and wooly aphid pests.

However, the productivity and recovery has been declined drastically to 58 t ha⁻¹ and 10.41% respectively during 2015-16. Considering the limited irrigation water availabilities due to increasing demand of water for domestic and industrial purposes, there is little scope to increase the area under sugarcane during near future. Similarly, considering the total network of sugar factories in Maharashtra and total requirement of sugarcane, diversification of cropping pattern from sugarcane to other field crops will not be the viable and permanent solution. Under the prevailing circumstances, the concentrated efforts are required to increase the productivity of sugarcane using various agro-techniques available and adoption of efficient water use systems like drip and sprinkler irrigation. This can be possible by strengthening the technology transfer programmes through the well set-up agencies like State Department of Agriculture, sugar factories and State Agricultural Universities.

Avenues to double the Sugarcane Farmers' Income by the Year 2022: Integrated Farming System Is Steering the Earning Wheel under Subtropical Indian Conditions by A.K. Singh, A.D. Pathak & Ekta Singh published in STAI 2017.

Sugarcane occupies an important position in agrarian economy of India Globally, sugarcane is grown in diversified cropping systems under varying edaphic and climatic conditions. As a result, not only sugarcane production fluctuates over the years but also the cost per tonne of cane produced varies considerably. Indiscriminate break-up of land holdings due to weakening of the joint family

combined with increase in human population is under woes. Per capita availability of land in India has declined from 0.5 ha in the year 1950-51 to 0.15 ha in the year 2000-01. Sugarcane based Integrated Farming System may hold promise to mitigate such problems and may prove as resource management strategy to enhance the income and sustained production of farm households while preserving resource base and maintaining a high level environmental quality. In view of changing market scenario, consumers' preferences and global competitions, new income generating opportunities need to be created through crop diversification in sugarcane 'Produce to Product Chain'. This would help in increasing the land utilization efficiency, reducing the production cost, economizing the use of market purchased costly inputs and making plant-ratoon system sustainable. Several crops and varieties are identified for intercropping in autumn and spring planting sugarcane at IISR, Lucknow. Apart from sugarcane based intercropping systems, components of the farming systems viz. dairy, duckery, poultry, horticulture, apiary, pisciculture and plantation crops viz., banana, papaya etc. along with crops may increase net profit of the farmers significantly. This in turn raises the socio-economic status of small and marginal resource constrained farmers and generates employment especially for rural women and youths, which help mitigate the goal of doubling the farmers' income. The findings of the research experiments conducted at IISR on Integrated Farming System clearly indicated that intercropping of potato in autumn and ladies finger in spring planted sugarcane along with the ancillary activity viz.

bee- keeping holds promise in increasing the net farm income.

Biological Validation of BT Sugarcane through Detection of Cry Protein Using Elisa by R.K. Singh, J. Rastogi & B.L. Sharma published in STAI 2017.

Sugarcane plants with improved resistance to the sugarcane borer, *Chilo infuscatellus* have been studied. Double antibody sandwich ELISA was performed to determine the Cry1Ac protein content in mature leaves of 50 putative transgenic events of sugarcane early maturing variety CoS 96268. The results showed that Cry1Ac protein expression was detected in mature leaves of five CoS 96268 transgenic events (BtS2, BtS4, BtS7, BtS9 and BtS12). ELISA analysis showed that Cry1Ac protein expression in leaves was variable and ranged from 2.53µg/ FWg in BtS-7- 20.04 µg/FWg in BtS-9.

Bio-Efficacy Studies Of Pupal Parasitoid, Tetrastichus Howardi on Sugarcane Internode Borer, Chilo Sacchariphagus Indicus (Kapur) by Sankar Manickam, Gowthaman Natarajan & Raghu Sankaran published in STAI 2017.

Pupal parasitoid, *Tetrastichus howardi* is a gregarious parasitic insect which recorded as primary parasitoid or facultative hyper parasitoid associated with a great number of lepidopteron insects. An inundative release of *T. howardi* in E.I.D., Parry (INDIA) Ltd., in sugarcane command area of Tamil Nadu and Pondicherry (India) regions covered more than 40000 ac per year for the management of sugarcane internode borer, *Chilo sacchariphagus indicus*. Perusal data on sugarcane area coverage by releasing this

parasitic insect, *T. howardi* showed an increasing trend among the farmers with an impact of village level demo and farmers training programs by the organization. An increased sugarcane yield from 2.0 to 4.0 tones recorded over control plots. Longevity, fecundity and parasitic ability of this parasitic insect in sugarcane field were confirmed by re-introducing sugarcane internode borer pupae manually in the field. Field study data showed that 100% parasitization in the nature by *Tetrastichus* and its progeny gained an average upto 34.0 insects/pupa, under conducive climate in the laboratory bioassay which produces up to 173.0 insects/pupa tested in two different agro climatic conditions viz., Pugalur and Nellikuppam sugarcane command area. The parasitic insect, *T. howardi* is well adapted in sugarcane ecosystem and it also support to mass produce in large scale on several lepidopteron insect pupae which can easily reared to implement this as one of the biocontrol agent under Integrated Pest Management program for the management of sugarcane borer pests.

Covsi 03102 - SUGARCANE VARIETY FOR HIGH RAINFALL ZONE OF MAHARASHTRA by R.S. Hapase, J.M. Repale & D.S. Pawar published in STAI 2017.

A sugarcane midlate maturing variety CoVSI 03102, developed from the high yielding parent 80 R 41 (General collection) and selected at Vasantdada Sugar Institute, Pune. It has been released for sugarcane growing area from high rainfall zone of Maharashtra state during May, 2016 for its commercial cultivation in Pre-season (October-November) and Suru (January-February)

planting. This variety is having specific characteristics like high cane yield, high sucrose content, higher single cane weight, absence of pithiness, higher cane diameter, good ratoonability, sparse flowering in flowering zone, easy detrashable nature with erect growth habit. This variety is an ideal for mechanical harvesting and drip irrigation with wider planting in future due to its erect growth habit. It is resistant to smut and moderately resistant to grassy shoot, rust and pookah boeng diseases and moderately susceptible to red rot (by plug method) and resistant (by nodal method). The variety is less susceptible to internode borer, scale insect, mealy bug and moderately resistant to sugarcane white wooly aphids (WWSA).

Divalent Cations Rich Soil For Quality Production Of Jaggery - A Case Study by Aneg Singh, Priyanka Singh & B.L. Sharma published in STAI 2017.

A village Haripara (Mau, in Uttar Pradesh) is known to produce quality jaggery from the month of November to April with 9-12% jaggery recovery, almost all the produce is exported owing to the excellent quality of the jaggery produced from sugarcane variety CoS 767. In view of this to assess the state of the soil and jaggery quality as well, analysis was carried out and it was observed that there was a broad range in soil reaction (4.8 – 8.5) of Haripara. The available organic carbon (0.46%) and phosphorous status were (10.23 kg/ha) low but, potassium (178 kg/ha) was at medium status. However, the nutrient status of available micronutrients viz; sulphur (11.58 mg/kg), zinc (1.05 mg/kg), iron (15.64 mg/kg) manganese 4.57 mg/kg) and copper (1.40 mg/kg) were stated to be above the

critical level. The jaggery produced from the sugarcane grown in this soil was less in invert sugars% (3.51%) and the color intensity was 110. The purity of the jaggery was recorded 83.92%. It could be concluded that the soil with high content of micronutrients (divalent cations) may be used for quality produce of sugarcane, which could result into production of better quality of jaggery.

Effect Of Environmental Parameters During Hardening Of Micropropagated Sugarcane Genotypes by T.E. Nagaraja, Sapna M.A. & Neelagangavva V. Navali published in STAI 2017.

To acclimatize the micropropagated plants, different approaches have been employed towards successful establishment of in vitro raised plants under ex vitro conditions. The difficulties associated with survival and growth of tissue cultured plants after transplantation are attributed to the poor control of water loss from the plants and their necessity to switch from heterotrophic to photoautotrophic nutrition. Aspects discussed include: the possibility of transplanting directly from shoot proliferation cultures and rooting; the importance of culturing for preconditioning plants prior to transplantation; stress reduction, disease prevention, and the importance of humidity, temperature and light intensity levels during transplantation. Highest shoot length of 27.33cm was recorded in Co86032, whereas it was 24.3cm in CoT12368 and 23.57cm in Co85004 at a light intensity of 8,000 to 15,000 lux. Average of 6 leaves per shoot was recorded in Co85004, 5.47 and 4.47 in Co86032 and CoT12368, respectively at 8,000 to 15,000 lux

in ex vitro conditions. However, the number of leaves and shoot length was numerically lower above 20,000 lux in all the three genotypes.

Effect Of In Situ Recycling Of Sugarcane Crop And Sugar Industrial Wastes On Soil Carbon Pools Under Sugarcane Land Use System by D.H. Phalke, M.C. Manna & A.V. Solanke published in STAI 2017.

A field experiment was conducted during summer 2011-12 at M.P.K.V Farm, Rahuri to evaluate the effect of in-situ recycling of sugarcane crop residues and its industrial wastes on soil organic C fractions like labile carbon, microbial biomass C, particulate organic C, KMnO₄ extractable C, physically protected particulate organic matter carbon (POMC) and significantly improved water stable aggregates in the cultivated soil under maize-soybean system. The active carbon pools like soil microbial biomass carbon (SMBC), water soluble carbohydrates (WHC) and acid hydrolysable carbon (AHC) was significantly improved in the treatment receiving 100% recommended dose of fertilizer along with in-situ compost of crop residues, press mud cake and methanated spent wash compost compared to burning of residues. Further it was observed that application of in-situ sugarcane residues with pressmud incorporation retained higher amount of total organic carbon (TOC), SMBC, WHC and AHC after harvest of maize.

Evaluation And Selection of Promising Sugarcane Genotypes Suitable For Tamilnadu Mills Through Aicrp Scheme by S. Rajeswari, A. Lourdusamy & S. Raghu published in STAI 2017.

The primary objective of any sugarcane variety development program is to develop improved varieties in terms of cane yield and sucrose content for the betterment of farmers and sugar industry. Continuous efforts are being made by the sugarcane breeders to achieve this across the country. In this study, four genotypes of early maturing group were evaluated through AICRP programme to identify a suitable variety for peninsular zone especially for Tamil Nadu mills. Two plant and one ratoon trials were conducted at Pugalur during 2010-11 and 2011-12 seasons. Among the four genotypes viz., Co 06001, Co 06002, Co 06022 and PI 06132 studied, Co 06022 was found to be superior over the three standards viz., CoC 671, Co 85004 and Co 94008 for all the field characters and cane yield. The CCS% of Co 06022 also showed better and on par with the best standard variety CoC 671 at 10th month age. Very good field performance of Co 06022 was observed in the demonstration plots at Pettaivaithalai, Nellikuppam (Tamil Nadu) and Puducherry. The big mill test of Co 06022 is resulted in superior quality and also recorded higher cane yield than Co 86032 in the farmers field. In addition, it has also shown drought and salinity tolerance in different types of soils in E.I.D.Parry command area.

“Satellite Mapping”-A Scientific Approach for Sugarcane Crop Area Estimation by Deep Malik published in Indian Sugar March, 2018.

Use of GIS and Geospatial technology is quite limited in India in the Agricultural sector, while it is being extensively used in developed countries. Indian Sugar Mills

Association (ISMA) had taken initiative for crop area estimation five years back, using Aerial mapping, image processing and GIS technology with the help of an external agency. Since then, this technology is being successfully used for sugarcane crop area estimation on PAN India basis. This is fact growing technology the benefits of which can have significant impact to the agriculture industry. This paper gives an insight into the basics of the process being used.

Differential Effects of Cold Stress on Chloroplasts Structures and Photosynthetic Characteristics in Cold-Sensitive and Cold-Tolerant Cultivars of Sugarcane by Su-Li Li, Zhi-Gang Li, Li-Tao Yang, Yang-Rui Li and Zhen-Li He published in Sugar Tech February, 2018.

Freezing often results in a significant loss of sugarcane production. An investigation was conducted in two sugarcane cultivars, GT28 (Guitang 28, cold tolerant) and YL6 (Yuanlin 6, cold sensitive) to understand the cold tolerance mechanisms. The plants at early ripening stage, 245 days after planting, were exposed to cold stress (0 °C) for 0, 2, 4, and 6 days. The changes in chloroplast structure, microtubule and physiological parameters under cold stress were determined. The morphology and chloroplast ultrastructure of the cultivar GT28 were observed normal while those of the cultivar YL6 was severely damaged and accumulation of starch grains in chloroplasts was evident under cold stress. At the beginning of cold stress, the microtubules in the cultivar GT28 was more obviously depolymerized than those in the cultivar YL6. With extended cold stress, the microtubules in the cultivar YL6 decreased noticeably and

the became indistinct, while the microtubule fluorescence in the cultivar GT28 was intensified, indicating that the structure of microtubules was reorganized. Consequently, the cultivar GT28 showed a greater photosynthetic activity than YL6 under cold stress. The cold tolerance of the cultivar GT28 appeared to be related to the integrity of chloroplast structure, the stability of microtubule structure, and balanced physiological metabolisms. These results revealed that more stable chloroplast structure and microtubule structure under cold stress are the important physiological foundation of cold-tolerant sugarcane cultivars.

Geographical Distribution, Botanical Description and Self-Incompatibility Mechanism of Genus *Stevia* by, Saikat Gantait, Arpita Das and Joydeep Banerjee published in Sugar Tech February, 2018.

Stevia rebaudiana Bertoni, popularly known as 'candy leaf', is a sweet native herb of Paraguay. It became economically important for its significant contribution to the sugar and beverage industry throughout the world. This plant has been known to contain a calorie-free natural sugar in its leaves, which is an alternative to other artificially produced sugar substitutes. *Stevia* is conventionally propagated through seed and cutting, owing to its self-incompatibility, insufficient pollinator activity, and poor seed set, which results in the origination of heterozygous plants with varying concentration of glucosides in leaves, with low multiplication rate. This article compiles the literatures and depicts an overview on the geographical

distribution, morphological, reproductive and cytological features, along with incompatibility mechanism of *Stevia* that would assist researchers to explore further and genetically refine this potential herb with immense medicinal importance.

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