

SHARKARA

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SHARKARA

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From Director's Desk.....



Coming close to the end of sugar campaign for the season 2016-17, except for few factories having special season, the sugar production figures appear to be around 20 million tonnes only with Uttar Pradesh regaining its no. 1 position as largest sugarcane and sugar producer. The decision of the Union Government to allow imports to the extent of 0.5 million tonnes helped in stabilizing the sugar prices in the domestic market to a realistic level.

Today the sugar factories in the subtropical region, Uttar Pradesh, in particular, may be better off due to good recovery levels and lucrative sugar prices but must look ahead from 10 years from now. A word of caution from my side regarding banking upon a single sugarcane variety which may cause serious problems from about 4-5 years from now when the variety may not yield results as being given now. As such, there is emergent need for developing more high yielding and high sugared varieties so as to have a varietal museum by 2020.

Another serious issue which may follow will be the power tariff's when the sugar factories shall have to compete with the power tariffs from non-conventional energy resources. Some states already suspending new power purchase agreements, alternate uses of bagasse are to be explored through commercially proven and economically viable technologies. Similar shall be the case with another co-product from the sugar industry i.e. molasses.

To make sugar industry sustainable, it has to learn the art of utilizing its products and co-products in an innovative manner as per the market demand and economics.

Good Luck ! 

(Narendra Mohan)
Director

OUR OCCASIONS:

VISITORS FROM ABROAD:

British Delegation led by Dr. Muyiwa Akintoye and Dr. Andrew Swift along with Prof. Kulkarni of IIT visited the institute for collaborative work on use of bagasse and trash for production of protein rich animal feed, bio-manure and invert sugar. They visited various laboratories and had detailed discussions with the faculty members from Biochemistry & Agriculture Chemistry division over the trials of proposed “Insect based Bioreactor Technology” for production of bio-manure & cattle feed from bagasse.



VISIT OF DIGNITARIES:

1. Dr. Sushil Solomon, Vice Chancellor, CSA Agriculture and Technology University, Kanpur visited the institute and looked at various newly developed facilities in various laboratories including Nano Brewery.
2. Shri Y.V. Patil, MLA, Indi Constituency Karnataka & Managing Director, Bheema Shankar Sahakari Sakhar Karkhana visited the institute on 2nd March, 2017 to discuss the issues relating to modernization cum expansion and setting of co-generation facilities at M/s Bheema Shankar SSK Ltd. Karnataka.
3. Mr. Pankaj Rastogi, Chief Operating Officer, Dalmia Bharat Sugar & Industries Ltd., New Delhi visited the institute to discuss the issues relating to improvement in the technical efficiency of Dalmia Group Sugar Factories. He also took keen interest in the research activities of the institute, particularly, production of bio-detergent from bagasse.

INTERACTIVE SESSION FOR PCS PROBATIONERS:

Two batches of PCS Probationers visited Institute on 10th and 13th January, 2017 to participate in an interactive session on “Issues related to sugarcane production, milling, marketing, management, cost and sugar recovery”. Prof. Narendra Mohan, Director gave them an

idea about the global & domestic sugar scenario. He also apprised them about the challenges before the sugar industry and about the issues relating to sugarcane productivity, sugarcane price fixation mechanization & value addition



FARMERS VISIT:

A group of Sugarcane farmers from Ganna Kisan Sansthan Prashikshan Kendra, Varanasi visited the institute on 22nd March, 2017 to seek information on newly developed sugarcane varieties, intercropping and on drip irrigation.



The farmers also visited the sugarcane farm and the Experimental Sugar Factory. Dr. Ashok Kumar, Asstt. Prof. Agriculture Chemistry apprised the farmers about the importance of ratoon management, crop rotation, soil health & inter cropping.

OUR RESEARCH AREAS:

The Institute is actively involved for the collaborative endeavors with the sugar and allied industries for their trouble shootings and applied R&D on the following important topics.

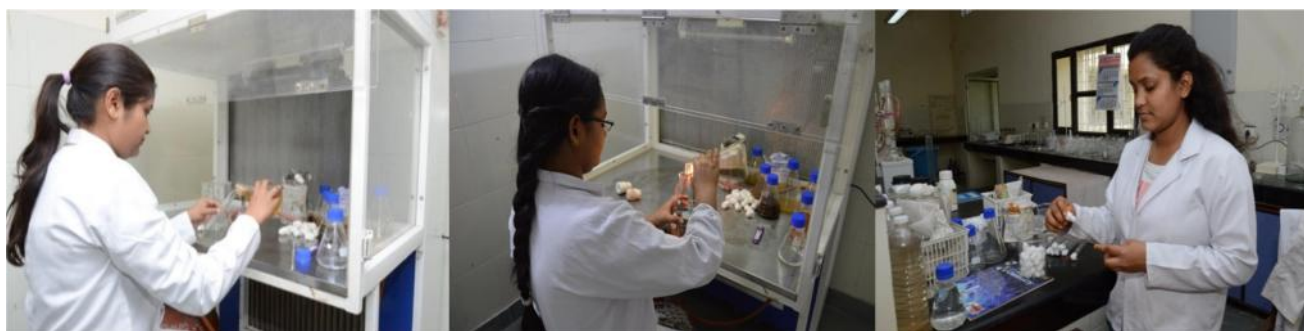
The Institute during the period took up R&D work on the following:

1. An investigation on micro-flora in different combination of press mud using different sources for biogas production-

The study was taken up for investigation on microflora in different combination of press mud using different sources for biogas production. The experimental set for the production of biogas using different combinations of press mud, cow dung / sewage, distillery spent wash and lignocellulologic material (green leaves and cane tops) was set up and microflora were isolated and purified. All the sets contained bacteria, a few contained yeasts and very few funguses. The study which was carried out at 14th and 21st day and results have shown the absence of fungus and mostly bacterial populations have been seen. Further characterization & identification of purified bacteria and fungus is being taken up.

2. Isolation and purification of yeast strains from saccharine materials and their performance for fermentative production of alcohol-

Various saccharine materials were screened for carrying out isolation work. The isolation of yeasts was started and good growth of cells was seen with different raw materials. The isolation of yeast strains has been done by taking fig fruit, jaggery, sugar solution and grapes. While no yeast could be obtained from jaggery, the yeasts obtained from sugar solution, fig and grapes were purified by pour plate method using serial dilution technique. The isolated and purified yeast strains are now being grown on diluted molasses for attenuation.



3. Production of invert syrup from Cane Juice, Molasses, Sweet Sorghum & Sugar Beet Juice-

The Sugar cane juice obtained from the sugar cane variety CoSe1434 and Co0238 was clarified using *Aloe vera* at a given temperature (using steam). The clarified juice was inverted by using fresh cation and anion exchange resins. The study was done using peeled sugar cane. The process yielded satisfactory results and further work is being taken up with sugar beet juices.



4. Graphene oxide from bagasse: synthesis & its utilization in carbo-catalysis-

A paper entitled “Utilization of lignocellulosic waste biomass of sugar industry as a precursor to access a carbocatalyst” was presented as a poster in Indo-German workshop on “Recent Applications of Carbohydrates in Chemistry and Biology” (RACCB-2017) held at Department of Chemistry, IIT BHU, Varanasi, U.P., India, during Feb, 14-16, 2017. A Patent application has also been filed on “A process for synthesizing graphene oxide from sugarcane bagasse”.



5. Studies on sugar assisted synthesis of Graphene-

Graphene, owing to its exotic physical and electrical properties has led the recent advances in material sciences and is finding its way into various fields including electronics, biomedical, environment and engineering. Chemical reduction of Graphene oxide utilizing hydrazine or its derivatives as the reducing agent is one of the highly explored synthesis

approaches for the Graphene preparation. However, they are highly hazardous and explosive. Organic chemistry division has been working on development of Eco-friendly synthesis of Graphene based materials using green chemistry. This study indicates sugarcane juice/molasses as new, green, and efficient reducing agent as well as stabilizing agent for Graphene oxide reduction. The prepared material has been characterized with UV-visible absorption spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy and X-ray diffraction (XRD).



6. Improvement in Sugar Quality by clarification of intermediate boiling house products –

Various intermediate boiling house products, viz A-heavy, B-heavy and C-light molasses collected from commercial sugar factories were treated with different doses of phosphoric acid and flocculants. After treatment, the samples were centrifuged in a lab centrifugal machine. About 50% reduction in turbidity and 10-12% reduction in ICUMSA colour value was observed with the treatment. Effect of dilution is being studied by keeping molasses brix at 40°, 50° and 60° Bx. Encouraging results have been obtained and further work is in progress.

7. Production of Bio-CNG from Press Mud-

Blue print for under taking pilot/ prototype scale trials using press mud with or without spent wash has been prepared to make high calorific value Compressed Natural Gas. Experimental set up was made for the production biogas using different combinations of press mud, cow dung / sewage, distillery spent wash and lignocellulosic material (green leaves and cane tops) to select the best combinations of press-mud and sugar industries waste.



RESEARCH PAPERS PUBLISHED/PRESENTED/SENT FOR PUBLICATION:

1. **“Bagasse Drying, an Efficient Way of Saving Fuel in Sugar Industry”** by D. Swain & Anoop K. Kanaujia presented during all India Seminar organized by The Sugar Technologist Association of India on 3rd February 2017 at Meerut, U.P.

2. **“Utilization of Lignocellulose Waste Biomass of Sugar Industry as a Precursor to Access a Carbocatalyst”** by Shri Narendra Mohan, Shri Vishnu Prabhakar, poster presented during

Indo-German workshop on **“Recent Applications of Carbohydrates in Chemistry and Biology”** (RACCB-2017) organized IIT BHU, Varanasi, U.P. India on 14th - 16th February, 2017.

3. **“Utilization of Solar Energy: An Opportunity for Indian Sugar Industry”** by D. Swain, Anoop K. Kanaujia and Vinay Kumar presented during all India seminar on **“Energy and Water Conservation”** jointly organized by SISSTA and SNSI at Belagavi, Karnataka on 25th February, 2017.

4. **“Spectrophotometric Determination of Phosphate in Sugarcane Juice using Organic Aqueous Media”** by Narendra Mohan, Vishnu Prabhakar, and Chitra Yadav published in the Indian Sugar, January, 2017.

5. **“Role of Sugar Industry in Uttar Pradesh Power Crisis”** by D. Swain, Anoop K. Kanaujia, published in Sharkara, Oct-Dec, 2016.

6. **“An overview of Indian cane molasses quality and need for alternate feed stocks”** by Narendra Mohan and Seema Paroha presented during the all India seminar organized by the AIDA on 22nd & 23rd February, 2017 at New Delhi.

7. **“Overview of Corrosion of Process Equipments in Indian Cane Sugar Industry”** by Narendra Mohan and Ashutosh Bajpai presented during all India seminar on **“Emerging Trends in use of Stainless Steel to combat Corrosion in Sugar & Allied Industries”** organized by The Sugar Technologists Association of India on 4th March, 2017 at Pune.

8. **“Effect of Potassium Application on Nutrient Uptake, Yield and Quality of Sugarcane & Sustainable Soil Health”** by Narendra Mohan, Ashok Kumar Yadav, Lokesh Babar & Prabhat Kumar Agrahari presented during National Conference on “Farmers Centric Agri-innovation for Sustainable Development” organized by C.S. Azad University of Agriculture & Technology, Kanpur on 24-25th March, 2017 at Kanpur.

9. “Biomass Energy: A step towards Economic & Environmental Sustainability in India” by Narendra Mohan, & Anoop Kumar Kanaujia sent for presentation during the forthcoming International Congress on Sugar & Sugarcane Derivatives being organized from 26 to 30th June, 2017 at La Habana, Cuba.

10. “Sugarcane Juice Utilization: Expeditious Green Synthesis of Graphene” by Narendra Mohan & Vishnu Prabhakar sent for presentation during the forthcoming International Congress on Sugar & Sugarcane Derivatives being organized from 26 to 30th June, 2017 at La Habana, Cuba.

11. “Sugarcane Productivity Enhancement-A Holistic Approach” by Narendra Mohan & Priyanka Singh sent for presentation during the forthcoming International Congress on Sugar & Sugarcane Derivatives being organized from 26 to 30th June, 2017 at La Habana, Cuba.

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OUR PROVISIONS:

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 took up the sale of these Standards from during the period (January-March 2017) issued 238 Sugar Standard Grades to 44 Sugar factories and other users.

Price schedule for the sugar season 2016-17:

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.9375/= each
3	Single Sugar Standard Grades	Rs.1200/= each
4	Empty Sugar Standard Glass Bottle	Rs.175/= each
5	Packing case	Rs.300/= 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	Taxes Extra as applicable

SEMINAR/WORKSHOP/TRAINING PROGRAMME ATTENDED:

1. Shri D. Swain, Prof. of Sugar Engineering and Shri Anoop Kanaujia, Asstt. Prof. of Sugar Engineering presented research paper on **“Bagasse Drying, an Efficient Way of Saving Fuel in Sugar Industry”** during the all India Seminar organized by The Sugar Technologist's Association of India on 3rd February 2017 at Meerut, U.P.
2. Shri V.P. Srivastava, Asstt. Prof. of Organic Chemistry attended Indo-German Workshop on Recent Applications of Carbohydrates in Chemistry and Biology (RACCB-2017) from 14-16th February 2017 at IIT BHU, Varanasi and made a poster presentation on **“Utilization of Lignocellulose Waste Biomass of Sugar Industry as a Precursor to Access a Carbocatalyst”**.



3. Shri Narendra Mohan, Director, National Sugar Institute, delivered key note address on **“Energy and Water Conservation”** during the seminar organized jointly by SISSTA and SNSI, at Belagavi, Karnataka on 25th February, 2017. Shri Vinay Kumar, Asstt. Prof. of Sugar Engineering and Shri Virendra Kumar, Technical Officer (Instrumentation) also presented paper on **“Utilization of Solar Energy: An Opportunity for Indian Sugar Industry”** during the seminar.



4. Shri Narendra Mohan, Director, delivered a lecture on **“Indian Sugar Industry-Recent Trends”** during the Faculty Development Program (FDP) on **“Emerging Trends in Food and Bioprocess Industries”** organized by Harcourt Butler Technical University, Kanpur on 10th February, 2017.
5. Shri Narendra Mohan, Director and Dr. (Mrs.) Seema Paroha, Prof. of Biochemistry attended national seminar on **“Production of Ethanol/Biofuels from alternate source, ZLD through**

effluent treatment” organized by AIDA at New Delhi on 22nd & 23rd February, 2017. Dr. (Mrs.) Seema Paroha, Prof. of Biochemistry also presented a paper on **“An overview of Indian cane molasses quality and need for alternate feed stocks”** during the seminar.



6. Dr. Ashutosh Bajpai, Prof. of Sugar Technology attended one day all India seminar on **“Emerging Trends in use of Stainless Steel to combat Corrosion in Sugar & Allied Industries”** organized by The Sugar Technologist’s Association of India on 4th March, 2017 at Pune. During the seminar Dr. Bajpai presented a paper on **“Overview of Corrosion of Process Equipment in Indian Cane Sugar Industry”**.



7. Shri Narendra Mohan, Director, National Sugar Institute inaugurated National Conference on **“Advances in Chemistry for Sustainable Development”** organized by Harcourt Butler Technical University, Kanpur on 22nd March, 2017 at HBTU Kanpur. He also delivered a lecture on need for a cohesive effort for development of low cost indigenous technologies with all concerned disciplines joining hand in hand.

8. Shri Narendra Mohan, Director, National Sugar Institute and Dr. Ashok Kumar, Asstt. Prof. of Agriculture Chemistry attended the National Conference on **“Farmers Centric Agri-innovation for Sustainable Development”** organized by C.S. Azad University of Agriculture & Technology, Kanpur on 24-25th March, 2017 at Kanpur. Dr. Ashok Kumar made a paper as well as poster presentation on **“Effect of Potassium Application on Nutrient Uptake, Yield and Quality of Sugarcane & Sustainable Soil Health”** during the conference.



TRAINING PROGRAMME FOR TECHNICAL PERSONNEL OF YEMEN CO. FOR SUGAR REFINING:

Three months training programme on Sugar Refinery for the IInd batch of Chemical Engineers of M/s Yemen Company for Sugar Refining, Hodeida, Republic of Yemen commenced at the Institute. Theoretical as well as practical training is being imparted to the trainees during the period on various techniques of raw melt clarification, concentration and crystallization.



हिंदी कार्यशाला:

सरकारी कामकाज में राजभाषा के रूप में हिंदी के प्रति जागरूकता लाने तथा उसके उत्तरोत्तर विकास हेतु संस्थान में 21 मार्च, 2017 को हिन्दी कार्यशाला का आयोजन किया गया जिसमें संस्थान के निदेशक ने सभी विभागाध्यक्षों को निर्देशित किया कि सभी अपने अधीनस्थ कर्मचारियों को हिन्दी में कार्य करने को प्रेरित करें जिससे कि राजभाषा विभाग के निर्देशों का पालन सुनिश्चित किया जा सके।



HOLI MILAN:

Old Boy's Association of the institute organized Holi Milan at the Institute on 19th March, 2017 in association with NSI Officer's & Technical Staff Welfare Association. A Kavi samelan was also organized on this occasion. Many alumni of the institute up to 1968 batch attended the function and shared their old memories.



EXPERIMENTAL SUGAR FACTORY:

The 100 TCD vacuum pan sugar factory is the unique feature of the Institute for providing first hand technical training to the 1st year student of Sugar Technology & Sugar Engineering Course and carrying out pilot scale trials.

The Experimental Sugar Factory started this year crushing season from 3rd February, 2017 & closed on 10th March, 2017. During the season, few new process equipments e.g. Rotary screen for raw juice screening, Lotus Roll and continuous centrifugal were installed.



REPUBLIC DAY:

The Institute celebrated 68th Republic Day on 26th January, 2017. On this occasion, Shri Narendra Mohan, Director hoisted the National Flag and took the salute from the security guards. Highlighting the commendable work carried out by the institute for upgrading teaching and

training facilities, he called upon the staff and students of the institute work in a mission mode so that the institute may achieve greater heights.



NATIONAL SAFETY DAY:

National Safety Day was observed at Experimental Sugar Factory on 4th March, 2017. Awareness was created amongst workers as how to get prevented from the industrial accidents. A fire-fighting demonstration was also made on this day to train the staff of Experimental Sugar Factory about use of fire extinguishers.



SHOPPING COMPLEX:

Shopping complex of the Institute made functional on 9th February, 2017 with opening of snacks bar & laundry shop. With more shops for utility items, medicines etc. to come up soon, it shall help the students and staff in meeting their daily needs.



VISIT OF STUDENTS FROM ENGINEERING & OTHER COLLEGES:

The students from various engineering and other colleges visited the institute's Experimental Sugar Factory and laboratories to learn about the manufacture of sugar and ethanol. The students also sought knowledge about the institute courses and carrier in sugar and alcohol industry.



VIDEO CONFERENCING:

The institute participated in the video conferencing on 10th January, 2017 through which the Hon'ble President of India addressed students and faculty members of various universities, Technical institutions and institutions of higher learning on the topic "Building a Humane and Happy Society."



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 to March, 2017 consultancy services were provided to the following:

1. M/s Riga Sugar Company Ltd., Dhanuka Gram P.O. Riga, Distt-Sitamarhi, Bihar.
2. M/s Mahamaya Sahakari Shakkar Karkhana, Ambikapur, Surajpur, Chhattisgarh.
3. M/s Dalmia Bharat Sugar & Industries Ltd. Unit- Jawaharpur, Shahjahanpur, U.P.
4. M/s Tamil Nadu Sugar Corporation Ltd., Chennai.
5. M/s HPCL Bio fuels Ltd., Unit Sagauli, East Champaran, Bihar.
6. M/s G.M. Sugar & Energy Ltd., Sangur Haveri, Karnataka.
7. M/s Bargarh Cooperative Sugar Mills Ltd., Tora, Bargarh, Odisha.
8. M/s Uttarakhand Cooperative Sugar Factories Federation, Dehradun, Uttarkhand.
9. M/s Dalmia Bharat Sugar & Industries Ltd. Unit- Nigohi, Shahjahanpur, U.P.
10. M/s Dhampur Sugar Mills Ltd. unit- Dhampur, Bijnor, U. P.
11. M/s Harinagar Sugar Mills Ltd., Harinagar, West Champaran, Bihar.
12. M/s Shri Bhima Shankara S.S.K. Distt-Vijaypur, Karnataka.
13. M/s Dalmia Bharat Sugar & Industries Ltd. Unit- Ramgarh, Sitapur, U.P.

RESEARCH ARTICLE:

Impact of Varietal Planning on Sugar Recovery & Sustainability of Sugar Industry in Northern India

By

Priyanka Singh¹ and Narendra Mohan²

1. Scientific Officer, UPCSR, Shahjahanpur, India
2. Director, National Sugar Institute, Kanpur, India

Abstract

The origin of sugarcane crop is basically from north India and its cultivation is done since ancient time. Initially old local varieties were used for sugarcane farming in rather un-scientific manner which resulted in lower yields of sugarcane. The production of State, initially known as United Province was much lower being around 18 t/ha. The requirement of sugarcane for the mills and sugar for the zone was unable to be accomplished. The cost of production of sugar and profitability of the sugar industry besides many other factors depends primarily on the availability of sufficient quantity of good quality sugarcane during the crushing season. The main reason behind low productivity and sugar production was lack of promising high sugared sugarcane varieties and the scientific method of cultivation. Due to lack of cohesive efforts, the farm productivity and sugar recovery from this part of the country remained much lower than the national average till few years back. However, concerted efforts during the last few years have resulted into a turn-around in the situation with significant improvement in the farm and factory productivities helping sugar factories to withstand the adversities of the unfavorable market conditions of sugar prices.

Keywords: Early maturing, Mid-late maturing, Sugarcane varieties, Sugar recovery.

Introduction

The sugar industry is one of the largest agro-based industries in Northern India. Around 45% of the area of sugarcane in the country is from this region but the total sugar production is less because of the low sugarcane yields and sugar recovery. The stagnancy in production of sugarcane and sugar recovery during last few decades not only made the

industry uneconomical but also adversely affected the farmers because of nonpayment of their produce and thus also effecting implementation of sugarcane development initiatives. On one side, farmers were aroused for their payment, on the other side the sugar industry threatened to shut because of higher sugarcane prices and un-economical conditions. In the state nearly 42 lakh farmers and approximately 75000 sugar mill officers/staff earning is based on sugarcane directly or indirectly. Sugarcane is the only crop in which the state advisory price (SAP) ones laid down by the government, the sugar mill are bound to pay to the farmers. This is the reason as to why inspite of such unfavorable conditions, this crop is popular among the farmers and the production is continuously increasing. The 2015-16 processing year was of relief for sugar industry, sugarcane farmers and sugarcane development department as varietal balance and favorable climatic conditions resulted into increase of almost one percent sugar recovery of processing units, which in turn eased the payment of sugarcane dues of the farmers.

Due to the gloomy situation persisting in the region from quite some time, lot of scientific research work was undertaken towards development of new varieties and farming technologies. Their adoption by the farmers, led towards increasing sugarcane production to approx. 67 t/ha and recovery up to 10.6 percent (2015-16). In this region of India the sugarcane is cultivated under approximately 20.52 lakh ha area and the entire sugarcane is consumed through 168 sugarcane societies by 117 sugarcane factories. The cane productivity and sugar recovery of this region was comparatively lower and almost static since last four decades. On all India basis, the progress was there in the country with respect to productivity of sugarcane from last couple of years but on the sugar recovery front the gain had been marginal and it does not figure out substantially.

As far as subtropical region of the country is concerned, one of the main reasons for stagnant recovery and comparatively lower sugar recovery was that the area under early maturing varieties (<25%) could not be increased up to the desired extent, although there exists much potential to increase the sugarcane productivity and sugar recovery of this region by giving preference for cultivation of newly released, early maturing, high sugar varieties (EMV) which tend to mature fast and accumulate higher sucrose% and purity in less time. The sucrose% of newly released EMV found to be sustained for the longer duration than the mid-late maturing varieties (MLMV). A study was carried out based on area under cultivation for early and mid-late maturing varieties and their prospective impact on sugar recovery in all the zones of Uttar Pradesh (northern region), during the year 2013-14 to 2015-16, so as to recommend the proper varietal balance to increase sugar recovery vis a vis production in this region. The results obtained show that increasing the area under early maturing varieties will make this sector more profitable as increased farm and factory productivities bringing win-win situation for both, farmers and millers.

Genesis

For increasing productivity of sugarcane and production of sugar besides use of scientific package of practices & organic manure, management of insect-pest and diseases, reducing post harvest losses are required, the most important factor is use of high sugared disease resistant early maturing varieties which could serve for longer duration. Varietal management is the optimum utilization of promising sugarcane varieties for a target population of environments for sustainable and profitable sugarcane and sugar production. Varietal scheduling helps cane growers and cane managers in determining the allocation of land to different varieties, their plant and ratoon crops and in planning the harvesting and crushing schedule during the peak ripening curve of varieties covering the possible crushing period to provide economic return to both growers and millers. Recently, several improved early maturing varieties have been developed through varietal improvement programme by different research institutes. The sucrose% of these elite early maturing varieties is found to increase across the crushing season (Table 1). Though the area under such early maturing varieties has increased in 2015-16, which resulted in the enhanced recovery of the state, however, there is still scope for increasing the area of early maturing varieties and completely discarding the area under rejected varieties. The proper varietal planning of early and mid-late maturing varieties and harvesting schedule together for the target area may help to a great extent in sustaining the sugar production also.

As we know, crushing of sugarcane starts during October/November and continues until March/April in this part of the country. The composition of varieties in the cane supply has a major impact on sugar recovery and total sugar production. Sugarcane is considered to be mature and ready for harvest when the cane juice has over 12.0 % sucrose and around 18% soluble solids. However, a compromise is made depending upon the accruing total revenue *pot vis a vis* cost of inputs. Varieties which attain such level at 10 and 12 months age from planting in February/March are usually classified as early-and mid-late maturing types. Early-maturing varieties are grown on less area than mid-late maturing varieties in sub-tropical area, despite studies that show increased sugar recovery in the tropics with those that are early maturing. Stevenson (1965) has also emphasized that the early maturing varieties differ in their optimum time of maturity, in their capacity to stand to the end of a long dry crop season without appreciable loss in juice quality, and in several other respects which are of importance commercially should be given preference over the other mid-late and late maturing ones.

Thus, there is a need to emphasize to increase the area under early-maturing varieties possessing high sugar and biomass content. The performance of varieties also advocate an optimal balance of early-and mid-late maturing sugarcane varieties which is important for high productivity, longer crushing periods and high sugar recovery (Priyanka

et al 2016) (Table 1). Keeping these issues in mind, it is important to evaluate an appropriate balance of early- and mid-late maturing varieties which is required to increase sugar recovery in the sub-tropical region of Northern India.

The study, carried out based on findings of area under cultivation for early, mid-late and rejected varieties in western, central and eastern zones of Uttar Pradesh during the year 2013-14 to 2015-16, revealed that the area under early maturing varieties during the year 2013-14 was 14.57 percent and the recovery was 9.26 percent only. However, the area under EMV increased by almost 35 percent thereby increasing the recovery by 10.6 percent in 2015-16 (Table 3 & 4). The data (Table 3, 4 & 5) also show that the total area under sugarcane cultivation was 23.60 lac hectare in 2013-14, which decreased to 20.52 lac hectare during the year 2015-16. However, despite of the decrease in the area, the sugar recovery and sugar production increased which may be attributed to the increase in the area of high sugar early maturing varieties (Table 3 & 4). It has been found that the newly released early maturing varieties have higher accumulation of sucrose at 10 months which gradually increases up-to mid April. However, for mid-late varieties, the accumulation of sucrose is at 12 months which gradually increases up-to April last (Priyanka *et al*, 2016). So, with early maturing varieties the crushing season could start almost two months early and would sustain up to mid of April, as after this period the decline in sucrose has been found in early maturing varieties. If crushing continues after mid of April the mid-late maturing varieties serve better in sustaining the sugar production. The recommendation for preference of early maturing high sugar varieties is due to the reason that during the whole crushing season (October- April) it serves a better recovery because of high sucrose percent as compared to mid-late varieties.

The early varieties which were bred previously used to be low in fiber content and so there was considerable difference in yield of early and mid-late maturing varieties. However, the new high sugar early maturing varieties (Co 0118, Co 0238, CoS 8436, CoLk 94184, CoS 08272, CoSe 03234 etc) are moderate in fiber content and it has been found that farmer can produce as much as 100 MT/ha yield, which is almost equal to mid-late maturing varieties. So the farmer cultivating/opting for these varieties are not at loss regarding cane weight, as payment in this region of India is done on weight basis (Priyanka *et al*, 2016).

Observations

The study was extended in this regard to analyze the impact of EMV in five processing units, located in western, central and eastern zones of Uttar Pradesh, and had achieved a high recovery in 2015-16. It has been found that, Bajaj Hindusthan Sugar Ltd., Kinauni, Meerut situated in western zone, sugar recovery was 9.13 during the year 2014-

15 when the area of EMV was 5.76 percent. However, the recovery increased up to 9.82 percent when the area under EMV increased to 12.24 percent during 2015-16.

The Saksaria Biswan sugar factory Ltd, in central zone, achieved sugar recovery 12.40 percent (2015-16) by increasing the area of early maturing varieties (viz; Co 0118, Co 0238, CoS 8436, CoLk 94184 etc.) up to 68 percent. In 2013-14, the area under cultivation for early and mid-late maturing varieties in this mill was 35 and 63 percent respectively, and the recovery was 10.17 percent only. In 2014-15 the area under high sugar early maturing varieties was increased to 49 percent thereby the sugar recovery could be elevated to 10.38 percent. As mentioned earlier, in 2015-16 the area of EMV was increased further to 68 percent, the recovery was stepped up to 12.40 percent (Table 6). Sugar recovery got increased by almost two units i.e. 100 tons sugar/day (for 5000 TCD) by increasing the area of EMV only.

The Balrampur Chini Mill Maizapur, Gonda, in eastern zone had very less area under EMV (2.22 percent) during the year 2013-14, however, the area was increased up to 12.52 percent in 2015-16 and the recovery got increased by one unit i.e. 10.61 percent (Table 6). It is obvious from these data that by increasing the area under EMV, sugar recovery was increased by a significant amount. It has been found earlier that the sugar recovery of tropical region has been appreciably improved by increasing proportion of early maturing-high sugar varieties over the years. These varieties have superiority of increasing recovery up to 1.5-2.0 units and ultimately had a definite impact on improving recovery in sub-tropical region.

Studies have also revealed that high sugar percent with apparent purity of juice in EMV is a consequence of early dehydration of the crop and a sharp drop in non-sugars rather than high sugar accumulation or synthesis (Rao and Yaragattikar, 1981). Apart from increasing sugar recovery, milling of early maturing-high sugar variety has many advantages viz ; lesser cane milled for unit weight of sugar produced, lesser transportation, longer crushing duration; lesser pollution load; economized sugar processing etc.

Conclusion

These results show that the early varieties should be preferentially planted over the mid-late maturing ones to increase sugar recovery in subtropical part of the country. Sugarcane as a raw material accounts for about 65-70% of the total cost of sugar production. Therefore, increasing the area of early-maturing varieties will ultimately increase the sugar productivity and potentially reduce the cost of sugar production. It is suggested that a 50:50 ratio of early to mid-late maturing varieties may be a good ratio for most of the sugar factories in the region to safeguard the interest of both millers and growers and should be taken into consideration. However, the same may be precisely fixed

keeping in view the behavior of variety in the particular area, tolerance to disease and pests and other local conditions.

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Table 1: Sucrose% of early and mid-late maturing varieties across the crushing season.

S.No.	Varieties	Months						
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr
Early maturing varieties								
1	Co 0238	14.50	16.40	17.07	17.43	17.83	17.46	19.69
2	Co 0118	15.91	17.13	17.51	17.92	18.54	19.36	20.86
3	CoS 8436	12.98	15.76	16.31	17.38	18.12	19.19	19.92
4	CoS 08272	13.69	15.33	16.51	17.44	17.96	19.24	20.43
5	CoSe 03234	13.73	15.27	16.08	17.05	17.67	18.72	19.47
Mid-late maturing varieties								
6	CoS 767	13.48	15.45	15.92	16.74	17.14	17.47	18.55
7	CoS 97261	13.70	15.27	15.79	16.50	16.96	17.87	18.78
8	CoS 08279	13.34	15.79	16.58	16.72	17.42	18.38	19.54
9	CoS 07250	13.98	16.11	16.37	16.89	17.37	18.49	19.10
10	CoSe 01434	13.46	15.81	16.37	16.64	17.46	18.50	19.75

(Mean value 2013-14 to 2015-16)

Table 2: Sugarcane area and production of Uttar Pradesh during 2013-14 to 2015-16

S No.	Crushing Season	Total cane area (lakh ha)	Total cane production (lakh t)	Production (t/ha)	Total cane processed (lakh t)	Sugar recovery (%)	Total sugar production (lakh t)
1	2013-14	23.60	1480.93	62.74	701.17	9.26	64.95
2	2014-15	21.32	1389.02	65.14	742.78	9.55	70.90
3	2015-16	20.52	1363.75	66.46	645.66	10.62	68.55

Table 3: Cane area of different maturing varieties during 2013-14 to 2015-16 in Uttar Pradesh

S.No.	Crushing Season	Total cane area (lac ha)			
		Area for EMV	Area for MLMV	Area for rejected varieties	Total area
1	2013-14	3.44	16.57	3.59	23.60
2	2014-15	4.55	13.58	3.19	21.32
3	2015-16	7.07	8.24	5.21	20.52

Table 4 Varietal spectrum of sugarcane in U.P. during the years 2013-14 to 2015-16

S.No.	Varieties (%)	2013-14	2014-15	2015-16
1	EMV	14.57	21.35	34.47
2	MLMV	70.20	63.71	40.14
3	Rejected	15.23	14.94	25.39
	Recovery%	9.26	9.54	10.60

Source: Cane development department, U.P

Table 5 : Agro-climatic Zone wise Sugarcane Scenario, 2013-14 to 2015-16

S	Year	2013-14				2014-15				2015-16			
.	State	Area under sugarcane (Lac ha)	Production (Lac ton)	Yield Mt/ha	Recovery %	Area under sugarcane (Lac ha)	Production (Lac ton)	Yield Mt/ha	Recovery %	Area under sugarcane (Lac ha)	Production (Lac ton)	Yield Mt/ha	Recovery %
1	West U.P.	5.89	411.94	69.94	8.86	5.29	376.48	71.17	9.32	5.12	377.34	73.70	10.08
2	Central U.P.	10.62	641.12	60.37	9.33	9.37	570.53	60.89	9.73	10.63	661.40	62.22	11.01
3	East U.P.	7.09	403.91	56.97	9.60	6.66	388.8	58.36	9.50	4.77	278.14	58.31	10.62
	Total (U.P.)	23.60	1456.97	62.74	9.26	21.32	1335.81	65.14	9.54	20.52	1316.88	66.46	10.60

Source: Cane development department, U.P.

Table 6: Year wise cane area and sugar recovery of sugar factories located in different agro-climatic zones of northern India.

S.No.	Year	Total cane area (hect.)	Area under EMV (%)	Area under MLMV (%)	Area under rejected varieties (%)	Total Crushing (lakh quintal)	Average sugar recovery (%)
A. Bajaj Hindusthan Sugar Ltd., Kinauni, Meerut							
1.	2013-14	27808	0.93	98.00	1.07	137.73	8.92
2.	2014-15	28756	5.76	92.52	1.72	139.87	9.13
3.	2015-16	29817	12.24	86.14	1.62	124.99	9.82
B. The Saksaria Biswan Sugar Factory Ltd., Sitapur							
1.	2013-14	27732	35.11	63.21	1.68	85.32	10.17
2.	2014-15	26827	49.78	37.66	12.56	108.42	10.38
3.	2015-16	33162	68.38	13.86	17.76	85.68	12.40
C. Dalmia sugar Nigohi, Shahjahanpur.							
1.	2013-14	22790	39	47	14	69.44	10.30
2.	2014-15	19579	54	41	5	76.73	10.53
3.	2015-16	20161	76	22	2	71.77	11.94
D. The Bajaj hindusthan sugar Ltd, Maqsoodapur, Shahjahanpur.							
1.	2013-14	18737	11.42	75.41	13.17	52.73	8.76
2.	2014-15	12541	29.10	66.91	3.99	54.18	10.06
3.	2015-16	11241	55.13	40.73	4.14	42.24	11.46
E. Balrampur Chini Mill, Maizapur Gonda.							
1.	2013-14	7630	2.22	19.44	64.61	34.58	9.61
2.	2014-15	6497	5.23	18.89	75.88	30.83	9.62
3.	2015-16	6975	12.52	24.60	62.88	27.28	10.61

Source: Extension division, UPCSR, Shahjahanpur

EMV= Co 0118, Co 0238, CoS 8436, CoLk 94184, CoS 95255, CoSe 03234, CoSe 98231 etc. MLMV= CoSe 1424, CoS 97261, CoS 97264, CoS 767, CoS 8432, CoS 08279 etc.

HAPPENINGS IN THE SUGAR INDUSTRY:

One held for murder of sugar factory director

Police cracked the murder of a director of a sugar factory in Ambad by arresting her brother-in-law in the case. Police suspect that Sumitra Honde was shot dead allegedly by the accused, identified as Vilas Honde (20) when she resisted his advances.

India's trade minister Nirmala Sitharaman says no plan to cut sugar import tax for now

India, the world's biggest sugar consumer, is not planning to cut import duty on the sweetener at least in the near term, Trade Minister Nirmala Sitharaman told reporters on 5th Jan, 2017.

Over 7 lakh quintals sugar produced in Haryana

During the current crushing season, the cooperative sugar mills in Haryana have so far produced over 7.81 lakh quintals sugar by crushing 90.06 lakh quintals sugarcane, besides exporting, 1, 73, 26,285 units of power. During the corresponding period last year, the cooperative sugar mills had produced over 6.11 lakh quintals sugar by crushing 71.01 lakh quintals sugarcane, reported by PTI on 5th Jan, 2017.

South Africa – Invasion of armyworms threatens cane crop

An outbreak of fall armyworms that has attacked corn plants in South Africa may spread to sugarcane in the KwaZulu-Natal province, where a warm climate would help the pest survive through the year.

Russia becomes world's biggest beet sugar producer, says minister

With sugar output breaching over 6 million tonnes in the current season, according to the Agriculture Minister Alexander Tkachev, reported the news agency TASS.

Sri Lanka – Gazelle Ventures and I.M.S. Holdings partner to build new US\$152 mln sugar factory

Singapore's Gazelle Ventures is to partner with I.M.S. Holdings to build US\$152 million cane sugar factory Sri Lanka, according to a government spokesman.

Jamaican government to invest over US\$7.8 mln in the sugar industry

The Jamaican government is planning to invest more than JM\$1 billion (US\$7.8 mln) through the Sugar Transformation Project to develop a sustainable private-sector-led sugar industry.

Brazil – Centre-South commences replanting cane

High global sugar price is encouraging investment in replanting cane in Centre-South, according to the industry group Unica.

Coca-Cola, Ferrero and Bacardi support growers to produce cane sustainably

In a perception management drive, several big brands have visibly embarked on sourcing sustainably produced cane for their end products.

Bahrain – The future of sugar refinery remains in doubt

Bahrain's sugar refinery stopped production last October and is preparing for a change of ownership.

Mauritius – 2016 sugar output increases to 386,00 tonnes

The 2016 sugar output in Mauritius was produced 385,757 tonnes of sugar at the end of the 29-week campaign, according to Jacqueline Sauzier, Secretary General of the Chamber of Agriculture.

Fiji to get €11 million from EU for sugar sector development

The European Union has indicated it would provide an additional €11 million (FJ\$22.6m) assistance to the sugar sector.

Demonetisation a sweet pill for sugar industry

At a time when most consumption-driven sectors dread the impact of demonetisation, the mega event has come as a savior for the sugar industry. With production set to be less than consumption, unlike recent surplus years, a demonetisation-led consumption decline comes as a strong agreement against the need and lobbying by some to encourage.

Sugar prices to trade higher: Angel Commodities

Sugar Futures closed higher last week on reports the sugar output may be lower than expected in the country. India's sugar production 2016/17 is likely to fall to 22mt, down 4.3% from an earlier estimate.

TDP demands revival of Nizam Sugars

Telugu Desam Party (TDP) working president A Revanth Reddy on Sunday said the Nizam Sugar Factory issue should be discussed in the Assembly and a way should be found out to reopen the factory.

Dhampur Sugar Mills Ltd. clarifies on IT search in its office

Dhampur Sugar Mills Ltd. has clarified with reference to certain reports in the media relating to illegal money conversion by some Jeweller, wherein it has also been alleged that

Income Tax searches, have been conducted at Delhi base corporate office of Dhampur Sugar Mills.

India to have sufficient sugar; no plans to cut import duty

The government does not have any immediate plans to cut import duty on sugar as the country would have sufficient supply of the sweetener considering fall in consumption this year and a likely bumper crop next year, reported on 8th Jan, 2017.

A year on, 2015 drought still hurts sugarcane, 32 of 147 mills shut

The drought that had hit the state's agrarian economy in 2015 continues to haunt its sugar industry. Poor harvest due to reduced area under sugarcane cultivation during the drought year has led to a shutdown of sugar mills weeks of the start of the crushing season reported on 8th Jan, 2017.

A grim season for sugarcane growers and stakeholders

Bidar, which used to be the fourth largest sugarcane-growing district in the State, is all set to lose the tag, as the districts farmers, hit by the long dry spell and unstable prices offered by sugar factories, seem to have reduced cane cultivation.

Sugar prices rally up to Rs. 80 a quintal strong demand

Sugar prices rallied by Rs. 80 per quintal at the wholesale market in the national capital today following brisk buying by stokists and bulk consumers coupled with lower production estimates, reported on 12 Jan, 2017.

Bank finds no takers for 15 sugar factories on the block

The Maharashtra State Cooperative Bank is facing a tough time due to the dismal response to its proposal to sale 15 cooperative sugar factories to recover Rs. 883 crore in outstanding loans.

Guyana – Srinathji Ispat seeking to take over Skeldon Sugar Factory

Indian company, Srinathji Ispat Limited has expressed interest in taking over the entire Skeldon sugar estate following a visit to the factory in January.

Philippines – New 40 MW cogen unit expected to commence operations in September at Victorias Milling

Victorias Milling Co. (VMC) is expecting the construction of new PHP 2 billion (US\$40.2 mln) bagassed-based cogen units with 40 MW capacities to commence operations in September.

Nordzucker to commence production of organic sugar beet

In response to demand for organic sugar, Nordzucker has taken steps to conclude contracts for the first organic sugar beet in 2017, and to market the first volumes of organic beet sugar in 2018. Germany and Denmark are identified by the company as the best locations for cultivating organic beet.

USA – Consumption of low calorie sweeteners jumps by 200% amongst children

About 25% of children and more than 41% of adults in the United States reported consuming foods and beverages containing low-calorie sweeteners (LCS) such as aspartame, sucralose, and saccharin in a recent nationwide nutritional survey, according to a study by researchers at the George Washington University Milken Institute School of Public Health.

Brazil – Bagasse based cogen output to increase in 2017

Brazil's sugar-and-ethanol sector is expected to expand cogeneration capacity in 2017, but at a lower pace than last year's.

Kenya – Seven new firms get sugar milling licence

Seven new sugar millers have been registered in the government bid to expand production and limit imports as Kenya prepares to open its market to unlimited imports from the regional trade bloc Comesa.

Jamaica – Government inviting investors to run a sugar factory

The Jamaica government is seeking investors to take over the operations of the Monymusk sugar factory after the owner Pan-Caribbean Sugar Company Limited, a subsidiary of Chinese-based Hua Lien International Holding Co. Ltd, ceased operations after significant losses.

Bihar clears ethanol project worth Rs. 97 crore

Investment proposals worth over Rs. 6,000 crore were cleared by the revamped state investment promotion board (SIPB), which met on Friday after its rules were notified last month. The maiden SIPB meeting, the first since the Industrial Investment Promotion Policy 2016 was notified, saw 122 investment proposals worth Rs. 6,465 crore.

Sugar factories need to include molasses' storage in existing licences

The food Safety and standards authority of India (FSSAI), in a recent order, has asked sugar factories to include the storage of molasses in its existing licences. The move is in line with the regulator's concerns about the lack of hygienic storage conditions for molasses.

Sugar mills body bats for lower sugar cess

In the run-up to the Budget, sources report the government may do away with Rs. 1.25/kg cess on sugar. It is learnt that Sugar Development Fund (SDF) the fund that enables sugar industry get loans along other financial assistance, may also be axed.

Cane growers await HC verdict on interest payment on delayed dues

Some 42 lakh sugarcane farmer families of Uttar Pradesh are awaiting Allahabad High Court's verdict regarding payment of interest to the tune of nearly Rs. 2,100 crore due to a delay in getting their cane price in 2012-13 and 2013-2014.

Don't push up sugar prices: Govt. to mills

The government has "forewarned" sugar mills from pushing up prices of the sweetener artificially and it has told industry representatives it would not hesitate to take steps to keep rates under check. The retail prices of loose sugar has increased by Rs. 8 per kg in the past one year.

India's sugar policy: Time to link cane prices to sugar prices

Indian government has been trying hard to control sugar price rally through a series of measures including a 20% export tax, imposition of stock limits on sugar mills and traders, and change in metrology rule that empowers it to fix the retail prices of essential commodities such as pulses and sugar- though with not much success.

Centre may cut its share for sugar subsidy

States may soon have to bear major share of the sugar subsidy if they want to continue selling the sweetner under public distribution system at cheaper rates. The Centre is likely to cut its contribution substantially.

55-year-old A.P. sugar unit closed

Officials have prepared to auction the five-decade-old Jeypore Sugar Company Limited, also known as Chagallu Sugars Limited, on Monday, in West Godavari district. The company has reportedly been running in losses for the last few years.

Team on drought study visits sugarcane fields

The Central team on drought assessments in the State visited sugarcane fields here on Tuesday to study the impact of drought. Investment interacting with farmers in Samandahalli village in Harur, the team sought information on the fall in the quality of cane owing to water shortage and the investment made per acre.

According to ISMA, the opening stock of sugar at the start of this year was 7.75 million tonnes.

According to ISMA, the opening stock of sugar at the start of this year was 7.75 million tonnes. With lower production of 21.3 MT and likely sale of 24.2 MT, the closing stock is estimated to be at 4.85 at the end of 2016-17 marketing year.

Centre May Scrap Rs. 4,500 Crore PDS Sugar Subsidy in Budget

Finance Minister Arun Jaitley may not offer Rs. 18.50 per kg subsidy for purchase of sugar to states for selling at a subsidized rate via ration shops in his February 1 Budget and save about Rs. 4,500 crore.

India likely to need higher sugar imports, says leading refiner

India's sugar production is likely to be lower than government estimates this season, raising the possibility of higher imports by the world's biggest consumer of the sweetener, the chief executive of leading Indian refiner Shree Renuka Sugars told Reuters.

From bitter to sweet: Behtar din for sugarcane growers, finally

Hindrao Burungale is spoiled for choice. This farmer from Chikhali Masur village in Karad taluka of Satara district is being courted by multiple sugar mills for his 130-odd tonnes of standing 'ratoon' cane on four acres.

Sugar production estimates cut on drought in key growing states

With drought hitting the crop in key growing states of Maharashtra and Karnataka, the Indian Sugar Mills' Association (ISMA) has revised downwards its estimates for sugar production during the 2016-17 season (Oct-Sep) to 213 lakh tonnes.

Working to offload existing stock, expect better Q4: Ugar Sugar

Ugar sugar is working to offload last year's stock and a better result in Q4, says MD Niraj Shirgaokar. Speaking to CNBC-TV 18, Shirgaokar says the margins were higher this quarter on account of higher valuation of stocks compared to last year. The company currently holds an inventory of 10 lakh quintals.

Sugar supply will end in April, say ration retailers

Sugar has been part of the public distribution system (PDS) in the state for nearly half a century, but, following the curbs imposed on sugar subsidy by the Union Budget, this is going to be a thing of the past, say ration dealers.

Amit Shah names scheme for cane farmers after Charan Singh

Addressing an election rally in RLD's stronghold Baghpat, BJP national president Amit Shah reached out to the Jat community, which has been opposing the BJP in their stronghold, and said the saffron party is the best bet for the community.

122 sugar mills in Maharashtra complete crushing ops on lack of cane availability

As many as 122 sugar mills have completed crushing operations in Maharashtra for the sugar season of 2016-17 and barely 28 mills are now crushing cane. Around 150 mills had participated in the crushing operations this season, according to the latest crushing report of the Maharashtra Sugar Commissionerate, reported on 17th Feb, 2017.

Double whammy for Idukki sugar cane farmers

In Marayur, jaggery production is a round-the-year business. When one field is cleared, sugar cane in the nearby farm will be ready for harvest. The sugar cane field over nearly 700 hectares is an attraction for visitors to Marayur.

Sugarcane farmers got highest price this year: Devendra Fadnavis

Promising to revive the ailing cooperative sector, Chief Minister Devendra Fadnavis on Thursday said that sugarcane farmers were given the highest remuneration this year. "The sugarcane farmers in Maharashtra were paid the highest fair price remuneration this year."

Jay Shree sugar unit eyes return to profit, buyer

The BK Birla Group's sugar business may turnaround in the current year with a profit of at least Rs. 20 crore, but Jay Shree Tea and Industries Ltd, which carved out the sugar unit from itself with the aim of selling it, has yet to find a taker.

Oil ministry to prepare plan for ethanol production & marketing

Two inter-ministerial groups on Monday decided to prepare a detailed plan for generation and marketing of bio-ethanol and making it compulsory for all government agencies and their affiliated bodies to ensure commercial vehicles hired and engaged by them get smart by them tags to cross toll plazas without waiting in queue.

Can't supply PDS sugar without Central subsidy, says state

Food and Civil Supplies Minister U T Khader on Monday said the state government will have to discontinue supply of sugar through PDS if the Centre does not restore its share of the subsidy component.

Sugar mill prices ease on regular arrivals, weak demand

Sugar mill gate prices closed lower by Rs. 10 per quintal at the wholesale market in the national capital today following regular arrivals from mills amid limited buying by stockiest and bulk consumers.

Bihar's ban on liquor gives ethanol fuel blending a high

Oil marketing companies (OMC) have come to the rescue of sugar mills in Bihar, stepping in to buy ethanol, which was once bought by liquor manufactures in the state. Following the imposition of prohibition in the state, the sugar mills were stuck with bagasse and its processing plants.

Sugarcane farmers to stage protest in Chennai on March 21 demanding dues from mills

The Tamil Nadu Sugarcane Farmers Association has sought the help of the state government in getting the outstanding dues of Rs. 2,300 crore from the private sugar mills for the cane supplied during the last four fiscal years.

Sugar stocks' rally continues; KM Sugar Mills zooms nearly 6%

Prices of sugar stocks have continued rallying in Monday's trading session, as recently, the report published by the Indian Sugar Mills Association (ISMA) has quoted the sugar deficit in the country to 18.54% in February 2017 as compared to 15% in mid-February 2016.

Sugar demand from soft drink makers may fall

Urban India's health fad isn't sweet new for sugar. Soft drink companies are looking up to a scorching summer, which weathermen predict will likely set in early this season, to help beat the latest trend of sluggish volume growth.

Nitrogenase effective in converting carbon dioxide into biofuels

University of California, Irvine molecular biologists have discovered an effective way to convert carbon dioxide (CO₂) to carbon monoxide (CO) that can be adapted for commercial applications like biofuel synthesis.

Clostridium thermocellum utilizes both CO₂ and cellulose in the production of biofuels

Scientists at the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) made the surprise discovery that a metabolic pathway to take up CO₂ exists and functions in a microorganism capable of breaking down and fermenting cellulosic biomass to produce biofuels including hydrogen and hydrocarbons.

US – Six biorenewables projects secure funding of US\$12.9 million from DOE

The US Department of Energy (DOE) has announced the selection of six projects for up to US\$12.9 million in federal funding, entitled, 'Project Definition for Pilot- and Demonstration-Scale Manufacturing of Biofuels, Bio products and Bio power'.

Uganda – President Museveni proposes 10% fuel ethanol mandate

President Museveni has directed the Minister of Trade, Industry and Cooperatives, Ms Amelia Kyambadde to bring to Parliament, within six months, fuel ethanol mandate of 10%.

DuPont awarded grant for high-efficiency biogas enzyme production

US-based DuPont Industrial Biosciences has secured a grant from the European Commission (EC) to demonstrate high-efficiency enzyme production that would increase biogas yields.

USA – As the biofuels mandate bill for oil refiners soars, Trump's advisor calls for change

Oil refiners shelled out a record over US\$2 billion to meet US biofuels requirements in 2016, a 70% increase that is fuelling a growing debate over who should shoulder the costs for meeting environmental regulations.

ABSTRACTS:

Microbial oil production from sugarcane bagasse hydrolysates by oleaginous yeast and filamentous fungi by FB Ahmad, Z. Zhang, WOS Doherty and I M O'Hara published in International Sugar Journal January, 2017.

This study investigated the potential use of sugarcane bagasse as a feedstock for oil production through microbial cultivation. Bagasse was subjected to dilute acid pre-treatment with 0.4 wt% H₂SO₄ (in liquid) at a solid/liquid ratio of 1:6 (wt/wt) at 170 C for 15 min, followed by enzymatic hydrolysis of solid residue. The liquid fractions of the pre-treatment process and the enzymatic hydrolysis process were detoxified and used as liquid hydrolysate (SCBLH) and enzymatic hydrolysate (SCBEH) for the microbial oil production by oleaginous yeast (*Rhodotorula mucilaginosa*) and filamentous fungi (*Aspergillus oryzae* and *Mucor plumbeus*).

Strategies for monitoring energy consumption in sugarcane processing factories by KM Foxon, RC Loubser, GT Smith and Davis H N Stolz published in International Sugar Journal January, 2017.

Sugarcane processing facilities throughout the world are attempting to improve energy efficiency for cost-saving and/or fibre recovery. Other industries have shown that significant savings can be made by monitoring energy consumption within the process and using this information to reduce unnecessary consumption. Energy use measurements before and after capital upgrades also provide metrics for assessing the effectiveness of the investment. This

paper reviews the energy monitoring literature both within the sugarcane processing industry and in other industries to establish best practice principles for energy monitoring.

Evaluation of the impact of a range of soilameliorants on soil chemical and biological properties by D Elephant N. Miles and P D lungele published in International Sugar Journal January, 2017.

Crop yields in southern African sugar industries are frequently limited by unfavourable chemical and biological conditions in soils. In addressing these problems, growers make use of various organic and inorganic products, depending on the nature of the limitation. However, the efficacies of numerous products currently in use remain untested. This investigation involved the evaluation of 12 products in a short-term (8 weeks) pot incubation study using a sandy, acid Cartref topsoil. The organic products included were chicken litter (CL), mushroom compost substrate (SMS), flyash, filterpress, vermicast, liquid CMS (CMS_L), and granular CMS (CMS_G). Inorganic products were the liming agents.

Chlorotic streak transmission and crop dynamics research by R C Magarey, K Sventek, J I Bull and KS Braithwaite published in International Sugar Journal January, 2017
Chlorotic streak disease (CSD) is transmitted in water, specifically drainage, flood or irrigation water. Research showed that transmission in water was increased by the addition of oxytetracycline (Terramycin). A two-hour inoculation period, where roots were dipped in infected hydroponic solution

containing the antibiotic, was sufficient to lead to significant disease levels in test plants grown in a hydroponic system. A hydroponic system incorporating no water circulation (still-hydroponics) was found more effective than one where the solution was regularly circulated.

Opportunities and challenges from the emerging bioeconomy for the sugar sector by Arvind Chudasama published in International Sugar Journal February, 2017.

Advances in industrial biotechnology has made sugar a superb feedstock to produce variety of platform chemicals via the engineered microbe route. This has been led by the development of metabolic engineering toolbox comprising omics technologies, computational systems biology, protein engineering and synthetic biology. The toolbox facilitates engineering of metabolic pathway in microbes to produce a desired molecule. This technology has facilitated many biotech start-ups whereby, in most cases, bioengineered microbes produce a variety of platform chemicals from sugar-starch feedstocks. The recent breakthrough in gene editing technology, CRISPR, is widely recognised as a marked progress in genetic engineering.

Using production-cost analysis to understand the competitiveness of sugarcane production: a comparison among Thailand, Vietnam, South Africa and Brazil by Samuel Balieiro, Thomas de Witte and Pipat Weerathaworn published in International Sugar Journal February, 2017.

The liberalization of sugar markets, along with lower logistic costs, has led to higher

competition among sugar exporters. Understanding the differences in production systems and costs helps to identify competitive advantages and to understand future trends in the sugarcane production sector. The agri benchmark typical farm approach was used to analyze production systems and calculate sugarcane production costs of typical farms in Thailand, South Africa, Vietnam and Brazil. To ensure international comparability, the data was collected by national partners in an internationally consistent manner through focus-group discussions. The groups were composed of growers, extension agents and consultants.

Soil organic matter under sugarcane: Levels, composition and dynamics by N. Miles, R. Van Antwerpen and S Ramburan published in International Sugar Journal February, 2017.

Soil organic matter influences numerous soil properties and processes, including bulk density, structure, temperature, water relations, nutrient availability and biological activity. This paper presents information on soil organic matter levels, composition and dynamics in sugarcane topsoils in the South African sugar industry. Major factors accounting for variations in soil organic matter levels are climate, management practices and soil texture. Soils in the hot, dry areas of the industry were found to have the lowest organic matter levels, with there being a strong positive relationship ($R^2=0.81$) between rainfall and organic matter content.

Microbiological stability of sugar beets during their storage by I. Błaszczuk, M. Molska, P. Bąk, A. Papiewska and M. Wojtczak

published in International Sugar Journal February, 2017.

Harvested sugar beets harbour an array of bacterial microflora which impacts sugar production. With the trend of sugar campaign increasing in Europe, there is a need for microbiological and chemical analysis of sugar beet during long-term storage. This study evaluated the effect of temperature and storage time on the microbiological state of sugar beets and the content of nitrates and nitrites. Findings indicated high microbiological stability during storage of not pre-frozen sugar beets, in relation to the total number of both bacteria and spores of thermophilic bacteria.

Comparison of the kinetic behavior of dextranase and pullulanase applied to pan boiling: Laboratory and factory trials by B. Ninchan, P. Sathong, W Vanichsiratana, K. Sriroth published in International Sugar Journal February, 2017

Dextran occurrence is widely spread out in the Thai sugar industry. Process streams contaminated with dextran are difficult to treat due to the high juice flow per minute and the high cost of enzyme. Pullulanase, an enzyme capable of hydrolyzing the α -1,6 glucosidic linkage, was studied by comparing its kinetic behavior with that of dextranase. Both enzymes were applied to high viscosity (highly contaminated) low water content massecuites A and C and also trialed in the crystallization of vacuum pan A and C in the factory. The results showed that in massecuite A and pan A, ($\sim 80^\circ$ Brix, 70).

Ion-exchange softening of clarified juice – results of pilot trials by V. Kochergin and J F

Alvarez published in International Sugar Journal February, 2017.

The presence of calcium ions in cane juices is the main reason for scaling of the heat exchange surfaces in raw sugar mills. The necessity to periodically clean heat exchangers, evaporators and vacuum pans results in either significant downtime or redundancy of the heating and evaporation equipment. In some cane mills up to 20-25 % of evaporators are continuously cleaned to maintain the required throughput. Gradual scaling also reduces efficiency of heat transfer and reduces potential for cogeneration. Removal of calcium by ion-exchange resins has been considered in the past but has not been implemented commercially.

Impact of increasing campaign length on sugars content of stored beet by Jean-Louis Striebig and Philippe Mery published in International Sugar Journal February, 2017.

In a bid to drive competitiveness, the trend to increase campaign length and with it, extending beet storage period is inviting the issue of increase in the presence of rotten beet delivered to sugar factories. With the abolition of sugar quotas, more than a few sugar companies are seeking to expand production, not by increasing processing capacity but rather by increasing campaign length.

Strategies for increasing availability and milling performance at Colombian mills by DF Cobo, JE Lucuara, AF Ospina and JD Montes published in 29th ISSCT Congress, 2016.

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). Additionally, a monthly follow-up to the main performance indicators in a milling tandem showed how roller shell wear impacts negatively on pol losses in bagasse. Following a proactive approach (FMECA), intermediate carriers and preparation machines were redesigned. In order to increase roller shell mean time before failure (MTBF) and reduce tooth fractures, welding procedures were studied and heat transfer during solidification of welding deposits has been modeled using FEA. Experimental procedures have been used to validate results. This paper reports advances in the entire research project.

A classification scheme for wear and corrosion by GM Davy and GA Kent published in 29th ISSCT Congress, 2016.

Many components in a sugar factory require regular replacement. The need for replacement comes from excessive wear and/or corrosion that changes the dimensions of the component and reduces its ability to function as designed. On a component-by-component basis, efforts are being made to improve the life of components through the use of better materials or

redesign to improve the operating environment. To aid in the process of identifying better materials, this paper presents a classification scheme for wear and corrosion failure modes. The classification scheme can be used to identify the type of wear or corrosion that is occurring so that materials suitable for withstanding the identified failure mode can be identified. Wear has been broadly classified into metal-to-metal wear, abrasive wear and fluid erosion. Corrosion has been broadly classified into corrosion producing material loss, corrosion producing property deterioration and mechanically assisted corrosion.

Applications of CFD (computational fluid dynamics) modelling on boilers in the sugar industry by P du Toit and SW van der Merwe published in 29th ISSCT Congress, 2016.

There are numerous well-documented phenomena that plague the efficient operation of bagasse boilers. Key parameters that influence boiler combustion and operation are studied with the aid of computational fluid dynamics. Combustion stability and efficiency has been linked to various parameters such as fuel moistures and air temperatures supplied to the boiler and are investigated in this paper as part of a case study. With the benefit of computational fluid dynamics (CFD) simulations, the influences of secondary air, fuel spreader geometry and air distribution were evaluated. The result of the high sand loading in bagasse is that sugar mills have accepted erosion in boilers as normal wear over the years. This leads to high maintenance cost. This paper details a case study that focused on reducing

erosion on an economizer by testing different geometries of ducting. Flow maldistribution is common in boilers, especially in the sugar industry where large air heaters are used. This leads to inefficient heat exchange, blockages, erosion and corrosion. A quasi-2D thermodynamic model has been developed to determine the gas velocities and tube metal temperatures. The output data is used to modify the air heater to increase the gas velocity which considerably reduced the probability of fouling.

Today's production requirements how material selection and innovative design contribute to their fulfilment by Irma Geyer and Andreas Lehnberger published in 29th ISSCT Congress, 2016.

For many years, the materials used for sugar production equipment were selected based on criteria such as material strength, corrosion resistance, availability and current prices. Today, additional requirements have to be considered, which are defined by the location where the equipment is to be installed. Examples include food safety (hygiene), operational reliability and maintainability. Material selection enhanced by innovative design allows meeting the highest requirements regarding process optimisation and productivity while also ensuring low wear and tear of the components, low maintenance, and a long service life. This paper gives examples to explain the selection of materials in view of present requirements. They include compliance with hygiene standards through use of inert materials, non-breakability, low surface roughness, cleanability, low abrasion, detectability, resistance, but also a long

service life and ease of maintenance. A particular focus will be placed on the consistent use of stainless steel, which results from most of the requirements mentioned. Furthermore, the latest innovations in centrifugal design will be presented; the basket design, for example, significantly contributes to a longer life, and to a simplification of the mechanical system, thanks to a reduced number of components. This helps not only to minimise maintenance requirements and thus costs and downtimes, but also reduces the risk of machine failures.

Improved design of a falling-film tubular evaporator with a maintenance-friendly novel juice distributor by DK Goel, Sanjay Awasthi and Rajesh Srivastava published in 29th ISSCT Congress, 2016.

Several variants of falling-film tubular evaporators (FFTE) are in use in the sugarcane industry. Most of these suffer from three main drawbacks: (i) occasional tube chokes due to uneven distribution of juice, (ii) absence of headroom between the top tube sheet and juice distributor necessitating its dismantling for mechanical de-scaling of tubes, and (iii) occasional cracking of austenitic SS tubes fitted in carbon steel calandria caused by thermal stresses due to widely dissimilar expansion at elevated temperature. A new design of juice distributor has been developed. It comprises an inlet weir box and a five-stage cascading system that forms a uniform shower of juice across the entire cross-section. It is installed at 2 m above the top tube sheet to facilitate easy access to various tubes for inspection or mechanical de-scaling without its dismantling. A segmented tray plate bolted to

the top tube sheet and having an individual tripod-type umbrella structure located over each tube ensures equal wetting of each and every tube, making the system failsafe. One 3300 m² FFTE unit with this design of distributor is installed at a sugar factory in India. It has successfully completed three harvesting seasons without any tube choke. This plant produces plantation-white sugar by the double sulphitation process and has to carry out mechanical de-scaling during the crop to maintain heat transfer efficiency. Thermal stress analysis of another FFTE unit has been carried out using advanced software to simulate stress, buckling and deflection behaviour at elevated temperature for combination of carbon steel calandria and different grades of SS tubes to develop a structurally strong design with enhanced operational reliability. FFTEs with SS439 material tubes are installed as 2nd-4th effect evaporators at a 24,000 tcd sugar plant of the White Nile Sugar Company, Sudan. In the first crop, there was a problem of tube chocking due to intermittent supply of juice arising out of frequent stoppage of milling process. In subsequent crops, the supply of juice to the evaporator station has been largely consistent and, hence, the problem of tube chocking was not experienced. This plant has completed three more crushing seasons without any tube failure or structural deformity.

Technologies for exporting electricity of 100 kWh/t of clean cane while producing white sugar: a success story by Mahesh P Joshi, Hasan Mushrif, Milind P Chavan and Anurag Goyal published in 29th ISSCT Congress, 2016.

There is increased focus on enhancing revenue through co-generation due to declining sugar prices over the last 6 years. Therefore, while setting up our 3500 t cane/day greenfield sugar project in Maharashtra (India) we have incorporated energy-conservation measures in all sections of the plant, without compromising the reliability and stability of its operations, to maximize electricity export per tonne of cane. A 23 MW co-generation power plant, based on 110 bar high-pressure steam cycle, designed for maximum power generation per tonne of bagasse fired with minimum auxiliary power consumption, was installed to extract maximum energy from sugarcane. Direct pumping of LP steam condensate from the evaporator to the boiler de-aerator was installed to eliminate the intermediate boiler feed tank, thus minimizing vent losses. A gravity-flow boiling house was adopted to minimize pumping. A quintuple-effect tubular evaporator set and condensate-flash recovery system were installed with vapor bleeding from only the first three vessels to ensure stability of the system. Bled vapors are used for juice heating in direct-contact heaters, molasses conditioning, massecuite boiling, pan washing, sugar melting and sugar drying. This along with installation of waste heat recovery system for sulphur burning has eliminated the use of live steam in the boiling house and also achieved a total steam consumption of 32% on cane. Energy-efficient flux-compensated magnetic-amplifier rotor starters for cane leveler/fibrizor drives, low-speed milling, multi-set point-control philosophy for mill-speed control, high efficiency electric motors with VFD for different equipment and pumps, energy-

efficient progressive-cavity pumps for viscous liquids and belt conveyors have been installed to reduce power consumption. We have achieved an electricity export of 100 kWh/t of cane crushed (without using cane trash) during the first harvest (2014-15) and we hope to better this figure during the current harvest.

Six-roll sugarcane mill: mathematical model, finite element analysis and its validation by strain-gauge measurement JK Kharbanda, DK Goel and Narender Kalsi published in 29th ISSCT Congress, 2016.

Each type of mill, depending on the number and configuration of rolls and type of drive, requires a separate mathematical model. Published work on mathematical models of mills have largely ignored the friction power absorbed at the roller journals. The force distribution among various mill components has been computed or assumed, but there has been very little validation of stress/strain values through field measurements. This paper reports on an opportunity for field measurement of total torque and its distribution between different rollers, development of a reliable mathematical model, solving of the model, static structural analysis, and its validation through strain-gauge measurement. A new mathematical model was developed for a six-roll mill and used for static structural analysis to obtain its stress pattern. Input values for the mathematical model, such as friction power at the roller journals and distribution of total torque between different rolls, were collected from laboratory tests and operating data of the milling tandem, respectively. Real-time strain-gauge measurement was carried out on

a 1980 mm long six-roll penultimate mill of the 8000 t cane/day milling tandem at Saraswati Sugar Mills, India during the 2015-16 harvest, in collaboration with the Automotive Research Association of India. Strain gauges were installed at 32 locations on the mill and its grooved pressure feeder. A portable data-acquisition system was deployed to acquire time-series data from the strain gauges and the DCS recorded mill-operating parameters. The acquired data was processed and analysed to determine the principal strain at different locations of the mill assembly. These strain values were converted into stress values using Young's modulus and then compared with the analytical values to fine-tune the model.

Possibility of increasing sugarcane juice extraction using microwaves by S Latifaltojar, M Shomeili and N Nasirpour published in 29th ISSCT Congress, 2016.

Sugarcane stalks comprise three main components: the hard external skin (rind), the inner fibre and the parenchyma cells (pith). Most of the stalk is water and the main component of the cane juice is sucrose. Microwave technology heats due to electromagnetic wave polarization from 300 MHz to 300 GHz. This heat was used to destroy the tissue of cane stalks and increase juice extraction with the aim of reducing the amount of energy required at the mill for extracting the juice. Three key parameters considered were the power of the microwave (540, 720 and 900 W), the duration of application (0, 60, 120, 180 and 240 s), and whether the extraction tests were done immediately and or after 24 hours. All tests were repeated three times using a semi-

industry Qubany mill, which has an approximately 47% extraction rate and was used as reference control unit. Juice extractions as quantity on cane, juice concentration (°Brix) and amount of energy that was necessary for crushing of the cane cells were determined. Under different combinations of microwave power and duration, extraction varied by about 1% within treatments. Maximum extraction was 53.34% at 540 W and 120 s. This represents an increase of up to 13.3% in comparison to the reference. In addition, the yield strength, ultimate strength and Young's modulus decreased by 54.4%, 53.9% and 53.2%, respectively. The study showed that the use of microwave radiation could increase juice extraction in semi-industry installations such as the Qubany mill.

Trouble shooting of mill operation by analysing the torque distribution between the rollers by Juliusz Lewinski, Paulo Grassmann, Mattias Fredriksson and Tomas Kallin published in 29th ISSCT Congress, 2016. Individual electrohydraulic drives allow constant measuring of the torque in each roller during milling operations. The automation of each mill operation and of the whole tandem allows working with the optimum torque in each mill, giving the maximum extraction. During optimum four-roller mill operation, the top roller takes the same portion of the torque related to the inferior rollers and additionally the input torque, if the fourth roller is moved by the top roller. The torques in each roller should be kept uniform but, in case of any mechanical problems inside the mill, the total torque or the torque in the individual roller will vary,

giving information that something has to be corrected. This paper presents the analysis of the milling operation in four-roll mills in Brazil, Mexico, Belize and the USA, where the torque in each roller of the mill was measured. The rollers of the mills were driven individually by electrohydraulic drives, thus allowing for easy continuous measurements of the torque and speed in each mill. The fourth roller was driven by the top roller, except in the USA, where the fourth roller was equipped with an additional individual drive. Analysis of the torque distribution in each roller allowed for detection of various mechanical problems inside the mill, including the wear of roller surfaces and also determining the torque in the fourth roller, which was found not to be higher than 5% of the total mill torque. The possibility of continuous torque measurement in each roller was found to be an excellent mill operation predictive maintenance and troubleshooting tool.

Enhancing milling efficiency and throughput through control philosophy - San Diego experience by C Lopez and K Bhosale published in 29th ISSCT Congress, 2016.

To improve milling efficiency and capacity, a new milling tandem was recently installed, comprising five 4-roll pinion-less mills, size 1170 mm diameter x 2134 mm with independent drives for each roll, suitable for 454 t cane/h to replace the five mill tandem of size 915 mm diameter x 1980 mm. The existing front end was retained without any major modification. The new tandem was commissioned in December 2014, was operated with the previous control

philosophy during the crop 2014-15, and achieved crop average throughput of 401 t/h of cane with RME 95.95% and bagasse moisture 48.5%, which was below the target. Analysis of the operating parameters revealed that the existing control philosophy based on controlling the 1st mill speed with the prepared cane belt weighing scale and the remaining mills' speed by single-set point loops for chute level and drive load caused very wide fluctuations in speed and torque, adversely affecting throughput and efficiency. The 2015-16 harvest started in November 2015 with the adoption of a new control philosophy based on (a) differential roll speed, (b) 1st mill top roll speed pre-set with respect to the target crush rate and de-linked from the prepared cane belt weighing scale, and (c) multi-set point loops to control the top roll speed of remaining mills in relation to their respective drive load and chute level. For the full crushing season of 2015-16, the new milling tandem achieved an average throughput of 505 t/h of cane at imbibition of 27.42% on cane, 96.92% reduced mill extraction, 1.58% bagasse pol and 48.16% bagasse moisture. This result is one of the best in Central America. The study has established that the multi-set point control philosophy is of immense help in narrowing the band width of speed and load fluctuations. Implementation of this, along with adoption of differential roll speed, leads to a substantial increase in throughput and milling efficiency.

The process energy value chain by RC Loubser, K Foxon, GC Hocking, E Gibson and S Mitchell published in 29th ISSCT Congress, 2016.

A cane sugar factory converts chemical energy from bagasse and supplementary fuel into thermal energy for use in production. Any energy that can be saved or used more efficiently will make bagasse material available for coproducts. Individual sections in the factory are often measured on parameters pertaining to their own function, but the optimisation of these parameters may not be beneficial to the performance of the factory as a whole. Maximising extraction by increasing imbibition, for example, increases the energy consumed by the evaporators. A universal indicator of energy performance is required to optimise the overall energy usage of the factory. In addition, such a measure may provide a benchmark for comparing energy usage among factories and over time within a factory. The Mathematics in Industry Study Group South Africa (MISGSA), at its workshop in 2015, was asked to seek a universal set of parameters that could be used to optimise the performance of unit operations without negatively affecting other sections of the factory. The team came up with the concept of an energy-use model similar to a supply-chain model. Each unit operation uses energy received to convert the material to other forms and possibly releases usable energy in the form of vapours or fuel. The possible applications for use of the vapour reduce with decreasing temperature. The energy-use efficiency of a unit operation depends on the amount and quality of the energy and material entering the operation, and the amount and quality of the material leaving the operation. Quality of the energy is measured in terms of enthalpy and temperature. Quality of material is measured in terms of theoretical energy required to

convert it to the final product, e.g. crystal sugar. This paper proposes the concept of using a supply-chain model for evaluating the performance of unit operations within a sugar factory in terms of energy efficiency.

The role of the JPMA mill coupling in energy conservation by MS Sundaram, DS Nikam and SS Ghadge published in 29th ISSCT Congress, 2016.

A conventional tail bar coupling can cause serious complications to the mill drive components. Misalignment between the mill and gearing, shaft cracks, thrust load, sluggish floating of the top roller, rounding of the shaft square ends, damage to the crown pinion, and damage to the last motion gear bearing due to excessive thrust are common problems associated with the tail bar coupling. The JPMA mill coupling is an alternative to the tail bar coupling that eliminates damage caused by misalignment between mill and gearing and reduces other problems caused by the tail bar coupling. This paper presents a study of the impact of the JPMA coupling during the 2014-15 crushing season. The primary objective of the study was to assess the effect on power consumption by replacing a tail bar coupling with the JPMA mill coupling. Data on axial thrust, power consumption, top roller lift, fibre % cane, primary extraction, pol % cane, and bagasse moisture were collected and analyzed. Strain gauges were used to measure axial thrust and torque. The measurements were carried out for 4 days and the comparative data recorded before and after the installation of the JPMA mill coupling are discussed and elaborated in this paper. Our study produced the following conclusions: average reduction in power

consumption of 8% with peak reduction of 12%; reduction of axial thrust, reduction in torque demand and increased transmission efficiency; improved mill performance.

Spectrophotometric Determination of Phosphate in Sugarcane Juice using Organic Aqueous Media by Narendra Mohan, Vishnu P. Srivastava and Chitra Yadav published in Indian Sugar, January, 2017.

An operationally simple, rapid and sensitive spectrophotometric method has been developed for the determination of inorganic phosphate in sugarcane juice. The present method utilizes cost effective, easily accessible reagents and is less interfered by high concentrations silicate anion. Thus, it represents valuable alternative to existing method for determination of phosphate i.e. volumetric determination using uranyl acetate reagent and spectrophotometric method based on molybdenum blue method. The present method is based on the color development due to the formation of yellow molybdophosphate anion in acidic ethylene glycol-water (EG-W) mixed solution containing Mo (VI) species. The system obeys Lambert-Beer's law at 400 nm in the concentration range between 3 to 14 ug P/ml. The colour intensity of the yellow molybdophosphate solution is found to be proportional to the amount of phosphate present in sugarcane juice. The reaction conditions as well as the various experimental parameters affecting the development and stability of the coloured complex are carefully investigated and optimized for the estimation of phosphate content in sugarcane juice. The optimized reaction medium and concentrations of the

reagents used are the 40 mM Mo (VI) and 0.2 M HCl 40% EG-W solution. For a comparison of the method phosphate content present in sugarcane juice was also determined separately following the official ICUMSA method. The result of the developed method compares well with that of the official method.

Process for Decolourization of Raw Sugar Melt by Deep Malik published in Indian Sugar, March, 2017.

Ion exchange technology replaces conventional method of colour removal such as activated carbon treatment and offers reduced running cost. This technology is preceded by Melt clarification system and multi bed Filtration process. It operates by passing the pretreated sugar melt through a combination of specialty suited ion exchange resins column. These resins have capacity to absorb the colour precursors. The exhausted resin bed can be effectively regenerated by using alkaline sodium chloride salt solution.

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