



Foreword

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Greetings!

I am happy to share my thoughts with you through the edition of VSI Bulletin. This has been a tough year and will go in the history of the mankind as an unprecedented year in which a pandemic brought the whole world to a halt and changed the everyday life, work and activities of the communities. I wish that the coming year 2021 comes with lots of opportunities, possibilities and hopes for everyone.

The Indian sugar industry completed the sugar season 2019-20 producing 27.5 MT of sugar as against 33.16 MT produced in the year 2018-19. We might see a bumper production in the season 2020-21 to the tune of 32 MT of sugar production because of favorable monsoon and increase in sugarcane area in key sugar producing states of Maharashtra, Karnataka and Tamil Nadu.

Total 460 sugar mills were in operation in the country and have produced 73.77 lac tons of sugar while in Maharashtra, 173 sugar mills are in operation and they have produced sugar 26.96 lac tons as on December 15, 2020 as reported by ISMA.

In order to boost the ethanol blending programme and provide relief to the sugar industry, the Govt. hiked the ethanol procurement price for supply year 2020-21 from

cane juice based ethanol to Rs.62.65, from B heavy molasses to Rs.57.61 and from C heavy molasses to Rs.45.69 per liter. The remunerative prices will encourage the millers to enhance the ethanol supply for blending & thereby supporting their revenues/profitability. The Sugar commissioner's data show that in Maharashtra 41 sugar mills started producing ethanol from B heavy molasses and are expected to produce 39 crore lit. Similarly, nine mills are producing 11.42 crore lit. from sugar syrup and 3 crore lit. of ethanol directly from cane juice. In this context VSI along with commissior of sugar, GoM, MRSSKSL, Mumabi organized interactive meeting on 'To enhance fuel ethonal production by diveting sugarcane juice / syrup or B-heavy molasses or sugar' under the chairmanship of Hon. President, VSI, Mr. Sharad Pawar.

In this quarter we conducted 2 Webinars, 2 physical training programs etc. with other events with detailed update is given and some of the articles published in the subsequent pages of this edition for the benefit of the readers.

Wish You Happy New Year, 2021

(RM Devarumath)
Editor



CONGRATUATIONS CONGRATUATIONS



Mr. Jaiprakash Dandegaonkar was elected as the President of the National Federation of Cooperative Sugar Factories Ltd., New Delhi. Mr. Jaiprakash Dandegaonkar is also the current Chairman of the Maharashtra State Cooperative Sugar Factories Federation Ltd. Mumbai. He is also the founder Chairman of Purna Sahakari Sakhar Karkhana Ltd., Dist.-Hingoli, Maharashtra and a member of Board of Trustee of Vasantdada Sugar Institute, Pune. Mr. Dandegaonkar a former State Minister of Cooperation and Textile in the Govt. of Maharashtra & having put in many years in public service. He has contributed significantly towards the growth and development of Indian Sugar sector.

VSI COMMITTEE MEETINGS VSI COMMITTEE MEETINGS

Technical Committee Meeting

The Technical Committee meeting was held on November 19, 2020 for the review of research work during 2019-20; ongoing technical performance of each experiment and future research program for 2020-21 of each Department and Section. The meeting was conducted under the chairmanship of Mr. Narendra Murkumbi, along with members of the committee viz., Mr. Vijaysinha Mohite-Patil, Dr. Indrajit Mohite, Mr. Shivajirao Deshmukh, Director General, VSI and Mr. Vikas Deshmukh, Director, Agriculture

Sciences and Technology, VSI.

Mr. Shivajirao Deshmukh welcomed Chairman and Members of the Technical Committee. In the meeting all the Departments/ Sectional heads presented their research review. In the meeting issues were discussed and suggestions were given by the Committee members. Meeting concluded with vote of thanks. The coordination of the meeting done by Dr. RS Hapase, Head & Principal Scientist, Plant Breeding Section.

Governing Council Meeting

Governing Council meeting was held on December 4, 2020. In the GC meeting Hon. President Mr. Sharad Pawar, Mr. Dilip Walse-Patil, Vice-President, Mr. Ajit Pawar, Dy. Chief Minister of Maharashtra, Mr. Shivajirao Deshmukh, DG, Mr. Vikas Deshmukh, Director, AST and

other GC members and Head Depts./sections of VSI were present. Some members of the Governing Council also participated in the webinar. In the meeting different issues were discussed. Later Mr. Sharad Pawar visited to Vasantdada farm.





EVENTS EVENTS

National Seed Day

Vasantdada Sugar Institute, Pune organized National Seed Day on October 01, 2020. This program was sponsored by ICAR seed project. On this occasion *Shiwarpheri* was organized at Lonarwadi & Naigaon seed production farm for cane grower farmers of sugar mills and Agriculture Assistants.

During the *Shiwarpheri* at Lonarwadi, Dr. RS Hapase, Principal Scientist & Head of Plant Breeding Section, gave the talk on '**Importance of released varieties & its identification**', Mr. SS Katake, Scientist & Farm Manager, talked on '**Sugar cane seed nursery & one eye bud settlings production**' and Mr. RG Yadav, Scientist & Head of Section Entomology on '**Sugarcane plant protection and its control measures**'.

Dr. JM Repale, Senior Scientist, Plant Breeding section gave introduction on '**Importance of released varieties & its identification**', Mr. RN Gaiwad, Scientific Officer, Farm Section, briefed about '**Sugarcane seed nursery & one eye bud settlings production**' and Dr. BH Pawar, Senior Scientist & Head of Plant Pathology Section, talked on '**Sugarcane plant protection and its control measures at Naigaon farm**'.

For this program total 40 participants of three sugar mills participated due to COVID19 pandemic disease, limited sugar mills was invited.

To Enhance Fuel Ethanol Production by Diverting Sugarcane Juice/ Syrup or B-heavy Molasses or Sugar

Interactive meeting and discussion on '**To enhance fuel ethanol production by diverting sugarcane juice/syrup or B-heavy molasses or sugar**' was organized by Commissioner of Sugar, Government of Maharashtra and *Maharashtra Rajya Sahakari Sakhar Karkhana Sangh Limited (MRSSKSL)*, Mumbai on October 02, 2020 at Vasantdada Sugar Institute, Pune. The meeting was chaired by Hon. President of VSI Mr. Sharad Pawar, along with Mr. Ajitdada Pawar, Dy. Chief Minister, Government of Maharashtra, Mr. Jayant Patil, Minister of Water Resources and Command Area Development, GoM, Mr. Dilip Walse-Patil, Minister of Labour and State Excise, GoM, Mr. Rajesh Tope, Minister of public Health and Family Welfare, GoM, Mr. Shamrao alias Balasaheb Patil, Minister of Co-operation & Marketing, GoM, Mr. Shambhuraj Desai, State Minister of Home (Rural), State Excise, Finance & Planning, Skill Development And Entrepreneurship and Marketing, GoM, Mr. Jayprakash Dandegaonkar, Chairman of MRSSKSL, Mr. Shriram Sahadu Shete, Vice Chairman of MRSSKSL, Mr. Harshavardhan Patil, Mr. Shekhar Gaiwad,

Commissioner of Sugar, Mr. Kantilal Umap, Commissioner of State Excise, Dr. Pramod Chaudhary, President, Praj Industries Ltd., Mr. BB Thombare, Chairman, WISMA, Mr. Rohit Pawar (MLA), Vice Chairman, WISMA, Mr. Prakash Naiknaware, Managing Director, National Co-operative Sugar Factories Federation, Mr. Sanjay Khatal, Managing Director, MRSSKSL, Mr. Shivajirao Deshmukh, Director General, VSI, Mr. PK Mirase, Assistant Secretary (Technical), Maharashtra Pollution Control Board and Officers of Commissioner of Sugar, Commissioner of State Excise and MRSSKSL attended the meeting.

On this occasion Hon. President of VSI Mr. Shard Pawar felicitated Dr. Pramod Chaudhari, founder chairman, Proj Industries Ltd., Pune, for his award as he became first Indian to be honored with George Washington Carver Award for Innovation in Industrial Biotechnology and Agriculture by Washington DC-based Biotechnology Innovation Organization (BIO) and IowaBio.



In the meeting industrialist presented their views and various issues related to production of fuel ethanol from sugarcane juice/syrup, B-heavy molasses and Sugar. The economics and disposal of distillery effluents through zero liquid discharge (ZLD) were also discussed.

After presentations, Mr. Ajitdada Pawar, Mr. Jayant Patil, Mr. Dilip Walse-Patil, Mr. Rajesh Tope, Mr. Shamrao alias Balasaheb Patil, Mr. Shambhuraj Desai, Mr. Jayprakash Dandegaonkar, Mr. Harshavardhan Patil, Mr. Shekhar Gaikwad, Mr. Kantilal Umap, Mr. BB Thombare, Mr. Shivajirao Deshmukh and Mr. PK Mirase, expressed their views on the existing problems faced by the sugar and distillery industry. They emphasized on present difficult economical conditions of sugar mills which is resulting into non availability funds for new

distillery, expansion of existing distillery and installation of ZLD technologies. They also requested the GoM for issuing licenses from commissioner of state excise and consent from MPCB and also requested to help for getting soft loan from central or state governments.

In concluding remarks, Mr. Sharad Pawar addressed to all distinguished guest and delegates. He appealed and requested to all sugar mills and distilleries to divert maximum sugarcane juice/syrup or B-heavy molasses for ethanol production that will help to bring down stocks of sugar and also improve the financial health due to maximum revenue generated from ethanol. He also ensured that issues raised by the participants should be discussed with DFPD and CPCB/MoEF officers to understand their views and further necessary action should be taken.



Interactive meeting presided over by Mr. Sharad Pawar Hon. President, VSI



Mr. Sharad Pawar Hon. President, VSI felicitated Mr. Pramod Chaudhari, founder chairman, Proj Industries Ltd., Pune

National Webinar on Preparations for Ethanol Production from BH Molasses, Cane Juice, Syrup and Sugar

National webinar on '**Preparations for ethanol production from BH molasses, cane juice, syrup and sugar**' was jointly organized by Vasantdada Sugar Institute (VSI) and the Ethanol Manufacturers Association of India, Indian Sugar Mills Association (ISMA), National Federation of Co-operative Sugar factories Ltd. (NFCSF), All India Distillers' Association (AIDA) and MRSSK Sangh Ltd. at VSI, Manjari (BK), Pune, India on November 4, 2020.

Total 240 participants attended the webinar. During the inauguration function, welcome address was given by the Hon. President of VSI Mr. Sharad Pawar. He highlighted current ethanol demand & supply status, ethanol blending policy and importance of renewable energy. He mentioned about National Policy on Biofuels - 2018 and new agenda of Golon Renewable Sector. He also emphasized on Gol's Make in India & *Swachh Bharat Abhiyan* for doubling of Farmer's



Income, Import Reduction, Employment Generation and Waste to Wealth Creation.

Dr. SV Patil, Head & Technical Adviser of Department of Alcohol Technology & Biofuels, VSI delivered the presentation on **'Challenges, strategy and cost-economics of ethanol production from multiple feedstock'**. He described the objectives and agenda of the event. He emphasized on Indian and world sugar balance sheet, ethanol demand and price trend. He explained how current ethanol blending demand can be met by diverting sugar to B-heavy route. This will help to reduce surplus sugar stock and also promote EBP. He discussed two case studies (with bio-compost and incineration routes) for fuel ethanol production using different sugarcane feedstocks (C-molasses, B-heavy molasses & Sugar cane syrup) and their combination. Mr. Abinash Verma, Director General, ISMA summarized the presentation given by Prof. SV Patil. He then shared his views especially on current ethanol pricing and EBP programme. He mentioned that sugar diversion to ethanol will help to avoid surplus sugar stock for timely payment of FRP to the farmers. He also emphasized on need of increasing distillery capacity to fulfill current ethanol demand.

Dr. R Dani, Head, Sugar Technology, VSI delivered presentation on **'Implementation of DFPD guidelines in sugar mill for diversion of BH molasses or other feedstock for ethanol production'**. He highlighted Part-I, II, III of DFPD guidelines. He also focused on guidelines & requirements of storage of different feed-stocks & colour coding under Part-II of DFPD guidelines. He also explained about diversion of sugarcane juice/syrup, production, dispatch and stock records of each feed stock, recovery calculations for partial diversion of juice/syrup.

Mr. Prakash Naikaware, Managing Director, National Co-operative Sugar Factories Federation summarized the presentation given by Dr. R Dani. He mentioned that around 426 cr lit of ethanol will be required to fulfill 10% ethanol blending by 2022. He pointed out that there is need to speed up process of EC clearance for EBP promotion.

Dr. Vidyasagar Sidnale, Sr. Sugar Technologist, Sugar Technology, VSI gave presentation on **'Challenges and**

remedies in sugar processing while diverting BH molasses or other feedstock for ethanol production'. He explained about advantages of BH diversion in sugar plant, challenges & remedies for BH diversion etc.

Mr. Vivek Pittie, President, ISMA summarized the presentation given by Dr. VP Sidnale. He highlighted about steam and other saving due to diversion of sugar to B-heavy/Syrup route. He pointed out that some pollution boards are rejecting bio-compost route for ZLD and also insisting on CO₂ plant installation which may cause additional cost burden on sugar mills and slowdown EBP.

Mr. Avinash Deshmukh, Technical Officer, Alcohol Technology & Biofuels, VSI delivered presentation on **'Implementation of DFPD guidelines in distillery for ethanol production'**. He explained National Biofuel Policy-2018, vision & goals of policy, Part-I/II & III guidelines in details. He also explained pricing of biofuels and DFPD guidelines in connection to ethanol storage (PESO Norms).

Mr. Rahul Patil, Technical Officer, Sugar Technology, VSI gave presentation on **'Methodology to be used for FRP recovery calculations during diversion of BH molasses or syrup'**. He explained about day recovery loss calculation during diversion of BH molasses, preparation of weekly report, fortnight report & RT7© report.

After presentations, Mr. Vijaysinh Mohite-Patil, President, EMAI, Mr. Jayprakash Dandegaonkar, Chairman of MRSSKSL, Mr. Shivajirao Deshmukh, Director General, VSI, Mr. Kantilal Umap, Commissioner of State Excise, Mr. Prakash Naikaware, Managing Director, National Co-operative Sugar Factories Federation, Mr. Vivek Pittie, President, ISMA, Mr. Abhinash Verma, Director General, ISMA and Mr. VN Raina, Director General, AIDA participated in panel discussion and deliberations on the webinar. Mr. Jayprakash Dandegaonkar emphasized that it is necessary to calculate profitability for different routes on case to case basis from VSI. He also mentioned about reduction of sugar stock by diverting it to ethanol production for survival of sugar industry in future. Mr. Kantilal Umap appreciated that the webinar was very elaborative, integrated and interactive by



involving various stakeholders from institutions, industry and Govt sectors. He informed about newly formulated state excise policy by GoM which is supporting EBP. Mr. Vivek Pittie mentioned about ethanol pricing formula need to put in public domain for increasing investor/sugar mill confidence. He also mentioned about ethanol blending need to be allowed more than 10% in surplus sugar state like Uttar Pradesh, Maharashtra and Karnataka.

In concluding remarks, Mr. Shivajirao Deshmukh emphasized that distillery capacity is limiting factor

in successful implementation of EBP and GoI should help sugar mills for increasing distillery capacity by providing financial & policy support. He highlighted that production of ethanol from sugarcane juice/syrup will be profitable if pollution board allows the industry to use land application for effluent disposal. Finally, he concluded the webinar with vote of thanks. Overall co-ordination and moderation of webinar was conducted by Mr. AN Jamadar, Mr. VP Ghule and Mr. Sagar Bramhe.

45th Foundation Day



Lighting the lamp by Mr. Shivajirao Deshmukh, DG, VSI on the occasion of 45th Foundation Day of VSI

VSI celebrated 45th Foundation Day on November 19, 2020. All Head of Divisions/Sections gathered at Board room. On this occasion, Mr. Shivajirao Deshmukh, Director General, lighting the lamp. On this occasion, Mr. Vikas Deshmukh, Director, AST and all Heads of Divisions/Sections were present.

World Soil Day

World Soil Day (WSD) is held annually on 5th December as a means to focus attention on the importance of healthy soil and to advocate for the sustainable management of soil resources. Soil science section celebrated the World Soil Day on December 8, 2020 under the theme 'Keep soil alive, protect soil biodiversity'.

Mr. Vikas Deshmukh, Director, AST, Dr. BD Bhakre, Head, Department of Soil Science and Agriculture Chemistry, MPKV, Rahuri, and all head of section and staff of Agriculture were present. Total 70 participants from 22 sugar mills and farmers were present online for this event.

Dr. Preeti Deshmukh welcomed the guest and all the participants and briefed the importance of world soil day. Mr. Vikas Deshmukh, focus on the integrated nutrient management practices for sustainable soil fertility and cane productivity. Dr. BD Bhakre delivered the lecture on '*Shashwat oos utpadanasaathee jamin aarogya aani eakaatmik annadravye vyasthapan*'. He briefed the importance of organic manure, application of chemical fertilizer on the basis of soil testing, reclamation of salt affected soil. The event concluded with vote of thanks.



TRAINING

Overview of Distilleries and Alcoholic Beverage Industry

Department of Alcohol Technology & Biofuels (AT & B), VSI conducted a two weeks duration tailor made short term training programme for their newly appointed officers of Commissioner of State Excise, Government of Maharashtra State on the 'Overview of Distilleries and Alcoholic Beverage industry' during September 21 to October 3, 2020. Total five officers were participated in this training course.

The course was inaugurated by Dr. SV Patil, Technical Adviser & Head, Department of AT & B. He introduced the staff of department of AT & B to the trainee participants. He elaborated the importance of the course to the participants. He also thanked the Commissioner of State Excise, Government of Maharashtra for sending the officers for the training at VSI.

The short term course covered topics such as on Global and national scenario of distillery industry and potential of the country to meet the demand and supply of alcohol, latest technologies of alcohol production from various feedstock, various types of fermentation & distillation processes, operating parameters and operational efficiencies, alcoholometry, production process of country liquor and Indian made foreign liquor (Whisky, Brandy, Rum, Gin & Vodka), malt alcohol production, beer & wine manufacturing processes, records and registers to be

maintained in CL & IMFL, maturation & aging, taxes and duties on molasses and alcohol etc. The course also included important demonstrations/practical in the training programme, which will be helpful for the State Excise Officers while working at distilleries and liquor manufacturing units.

In the concluding session on October 2, 2020 the training programme manual was released by Mr. Kantilal B. Umap, Commissioner of Sate Excise, GoM. Other senior officers of State Excise namely Mr. Yatin Sawant, Joint Commissioner (Molasses & Spirit), Mr. Prasad Surve, Divisional Deputy Commissioner, Pune Division, Mr. Sunil Chavan, Divisional Deputy Commissioner, Thane Division and Mr. Santosh T. Zagade, Superintendent, Pune and Mr. Shivajirao Deshmukh, Director General, VSI were present. Dr. SV Patil briefly presented the departmental activities to the Commissioner State Excise and their Officers. Director General also explained them regarding activities of VSI in general. During the session detailed discussion were take place on analytical facilities available at VSI for alcohol beverages industry. Discussion was also held on the liquor and/or wine production from various feedstocks. The training concluded with distribution certificates to the officers.



The training programme manual was released by Mr. Kantilal B. Umap, Commissioner of Sate Excise, GoM. along with Mr. Shivajirao Deshmukh, Director General, VSI.



The officers of Commissioner of State Excise, Govt. of Maharashtra for the training programme in Alcohol Technology & Biofuels Department, VSI



Webinar on MPCB Logbook Module: How to Fill it up?

Implementation of environmental regulations has become very stringent. This has also increased the documentation and online submission of related documents. One such development is the introduction of the Logbook Module by the Maharashtra Pollution Control Board (MPCB) last year. The data has to be submitted online on a regular basis. However, many of the Environmental Officers/Managers working in the sugar industry are facing problems in filling/ submission of this data. To help the environmental officers in handling this issue, the Department of Environmental Sciences, Vasantdada Sugar Institute organised a webinar on **'MPCB Logbook Module-how to fill it up?'** held on December 15, 2020. The webinar was attended by staff of around 90 sugar mills & distilleries.

Dr. Deepali Nimbalkar welcomed the participants and gave the background of the subject. She explained the significance of documenting the data correctly to avoid future problems. She also asked the participants to discuss the issues faced by them. After this, Mr. Shivajirao Deshmukh, Director General addressed the participants. He stressed on the significance of environmental issues and VSI's role in awareness about them. He asked everyone to understand the details of the form properly and discuss in detail with the expert panel.

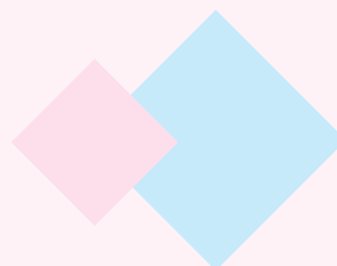
This was followed by a detailed presentation by Dr. Eknath Alhat on **'The MPCB logbook module'** which included the information to be filled and the calculations for the various units of the ETP. He also explained about the data to be filled for distilleries and some of the lacunae in the form. Mr. Kalyan Gaikwad, Environment Manager, Nira-Bhima SSK Ltd, then gave a live demonstration of actual form filling on the MPCB website. Mr. Rajendra Gophane, Environment Manager Daund Sugar Ltd also gave some information regarding distillery data. This was followed by panel discussion on the various issues

faced by the environmental staff in sugar mills & distilleries. The panel also included Mr. Gavhane from Vitthalrao Shinde SSK Ltd. & Mr. Ashok Suryavanshi from SGZ & SGA Sugars Pvt. Ltd. Mr. Jitendra Mane, Environment Manager, Karmayogi Shankaraoji Patil SSK Ltd summed up the problems faced in filling up the form. In addition to queries raised regarding the logbook module, participants also cited the lack of basic laboratory facilities and manpower for environment management cell in many sugar mills. Most of the queries raised by were answered satisfactorily and Dr. Nimbalkar gave the assurance of taking up the unsolved issues with the MPCB.



The Director General in his closing remarks expressed his satisfaction at the enthusiastic participation in the webinar. He assured the participants of the support of VSI in environmental issues and also of conveying the issues raised in the webinar to the MPCB. The webinar ended with a vote of thanks by Dr. Amol Deshmane.

As a follow up to the webinar a letter on suggestions for improvement in the MPCB logbook module was sent to the Chairman MPCB, Mr. Sudhir Shrivastava by the Director General. The Chairman has responded very promptly and positively that MPCB will take up the suggestions and make changes to the format of the logbook.





Advanced Technologies in Sugarcane Agriculture

The two days residential training programme on **'Advanced technologies in sugarcane agriculture'** was organized during November 25 to 26, 2020 for officers and staff members of Divisional Joint Director of Agriculture Aurangabad and Latur sponsored by National Food Security Mission.

In this training total 36 participants Divisional Joint Director of Agriculture, (Aurangabad 20 & Latur 16) including Agriculture Officers, Agril. Assistants and Agriculture Supervisors participated.

The training was inaugurated by Mr. Vikas Deshmukh, Director of AST, in presence of Heads of section and representative from participants. Dr. GS Kotgire, Scientist, Plant Pathology section welcomed all the participants and others. During the inaugural speech by Mr. Vikas Deshmukh highlighted the importance of the training and appealed to all officials to adopt integrated cropping system and focus on integrated nutrient management for increase in productivity of

sugarcane crop. He appreciated all participants came for training in the Covid 19 situation. He also instructed to follow the safety guidelines.

During training modern and scientific sugarcane cultivation technology was taught which covered the lectures on various topics like sugarcane varieties and varietal planning, seed nursery management, tissue culture, modern planting techniques, weed management, soil fertility and fertilizer management,

irrigation water management, use of bio-fertilizers, farm mechanization, ratoon management and integrated disease and pest management and practical's and field demonstrations was also given. In the plenary session, the participants discussed their doubts from the subject experts. In the concluding function, the representative trainees expressed their views. The certificates were distributed to the trainees and event was concluded with Vote of thanks by Mr. BH Pawar.



Inauguration of training program by Mr. Vikas Deshmukh, Director, AST, VSI



Certificate distribution to the participants by Mr. Vikash Deshmukh, Director, AST, VSI



Participants in the training program



PARTICIPATION BY VSI STAFF

A cloud HD video meeting was arranged by Institution of Agricultural Technologists (IMAT), Pune on November 22, 2020. Mr. Vikas Deshmukh, Director Agricultural Sciences & Technology Division, VSI was invited for a lecture on **'Advanced Technologies for improving sugarcane productivity in Maharashtra state'**. About 600 technologists, researchers, sugar mill officers and progressive farmers attended the presentation.

A virtual meeting of World Association of Beet and Cane Growers (WABCG) was held during November 16 to 30, 2020 in three phases. Vasantdada Sugar Institute is a member and observer to this association. Mr. Shivajirao Deshmukh, Director General VSI and Mr. PV Ghodke, Scientist, Agronomy Section attended these online meetings. Detailed discussions on world sugar stock, sugar pricing policy, ethanol production- pricing, effect of COVID-19 on sugar industry and various problems faced by the industry was held during these meetings. Director General VSI presented the **'Indian scenario of sugar & ethanol production, sugarcane production, productivity, new achievements and research area for beet & cane cultivation'**.

Poornam Ecovision Foundation is an NGO in Pune working on environmental problems particularly solid and e-waste management through recycling and upcycling. They have been organizing a webinar series under their awareness initiative on every Wednesday since August 2020. The 16th webinar in the series was delivered by Dr. Deepali Nimbalkar, Sr. Scientist, Department of Environmental Sciences on **'Opportunities in Wastewater Treatment'** on November 25, 2020 through facebook live. Dr. Nimbalkar began her presentation with the significance of the wastewater treatment in sustainable development. She explained that it was one of the greatest

untapped opportunities the world over and also gave the value of the wastewater treatment market in India. She listed out the wide range of career opportunities in wastewater treatment ranging from ETP design, operation & maintenance, chemicals & microbial cultures to management of various services. She also elaborated on the scope for entrepreneurship in the field.

The webinar got good response with around 50 attendees who participated in a Q&A session after the presentation. The video of the webinar has also received over 1200 views since then.



POORNAM ECOVISION FOUNDATION PRESENTS
Webinar on-

OPPORTUNITIES IN WASTEWATER TREATMENT

One of the greatest, untapped opportunities in the environmental field. Know it from the experts.

Speaker:
Dr. Deepali Nimbalkar
Sr. Scientist and Head,
Department of Environmental Sciences,
Vasantdada Sugar Institute
ds.nimbalkar@vaisugar.org.in

DAY & DATE:
25th November,
Wednesday
TIME:
4:30 PM to
5:30 PM
FACEBOOK LIVE



Memorandum of Understanding (MoU) between VSI & ICAR - NIASM, Baramati

ICAR's National Institute of Abiotic Stress Management, Malegaon Tal. Baramati and Vasantdada Sugar Institute, Manjari (Bk.) Pune signed a MoU on December 28, 2020 for collaborative research work for the management of abiotic stresses in sugarcane and allied crops. Under this program research trials with the technologies developed by both the institutes will be integrated as well as new technologies will be jointly researched out for developing farmer friendly technologies to manage the abiotic stresses like drought, salinity, high and low temperature, hail storm as well as flood. For this purpose, the scientific knowledge, the laboratory and field infrastructure of both institute will be shared. Further, for managing of abiotic stresses training programs/ workshops/ symposia etc. will be conducted jointly for the agriculture staff of sugar mills.

In first phase of implementation, the program of the trials for management of drought stress in sugarcane has been planned. A joint research proposal by both the institute along with Bhabha Atomic Research Center, Mumbai has been also submitted to Board of Research on Nuclear Science, Govt. of India for utilizing the chitosan and thiourea nanoparticles for enhancing the drought stress tolerance in sugarcane. Apart from this the microbial consortia, microbial polysaccharides, nanoparticles conjugates developed by both the institute will be evaluated for

management of different stresses in sugarcane as well as other horticultural crops.

Dr. Himanshu Pathak, Director of NIASM, and Mr. Shivajirao Deshmukh, Director General, VSI, Pune signed the MoU in presence of Dr. Jagdish Rane Principal Scientist & Head and Stress Physiology Division, NISAM, Mr. BK Sinha, Administrative officer of NIASM, Mr. Vikas Deshmukh Director, AST, VSI, Mr. PV Ghodke, Scientist, VSI and Dr. SG Dalvi, Scientist, VSI.

During the program, Dr. Pathak presented the different activities by NIASM and Dr. Rane briefed about the agenda of MoU. Mr. Shivajirao Deshmukh briefed about VSI activities and assured support for implementing the joint research work. He suggested that the farm facilities of VSI at different locations may be utilized for different trials going to be conducted for salinity, drought etc. He invited all the scientists of NIASM to VSI for exploring the possibilities of research trials for management of different stresses. Mr. Vikas Deshmukh also supported for the same stating that the NIASM will help in advancing the technologies developed by VSI to other crops stress management and yield improvement. He stated that the advanced infrastructure available with NIASM would be useful for screening and advancing the stress tolerant elite sugarcane genotypes. Later the VSI team visited to the different laboratories, phonemics facility and the farm facilities at NIASM.



Signing on MoU between VSI and ICAR-NIASM



VSI Delegation at ICAR-NIASM



VISITORS TO VSI

Local Enquiry Committee constituted by Savitribai Phule Pune University under the chairmanship of Prof. Suresh Gosavi, visited VSI on November 25, 2020. The other members of committee were Dr. Sanjay Gaikwad, Dr. Vinay Kumar, Dr. Rajendra Patil, Dr. Dnyaneshwar Mahajan for the affiliation to Vasantdada Sugar Institute as a Research Center leading to Ph.D. program and Post Graduate Courses of M.Sc. Wine Brewing & Alcohol Technology and Environmental Science. The committee visited all the departments to see the infrastructure of VSI. During their visit concern scientist explained the activities of department.



Prof. Suresh Gosavi, Chairman, felicitations by Mr. Shivajirao Deshmukh, DG, VSI



Visit of members of Local Enquiry Committee of SPPU to Alcohol Technology and Biofuels Department of VSI



Interactive meeting with Local Enquiry Committee constituted by SP Pune University presided over by Mr. Shivajirao Deshmukh, DG, VSI

Following visitors visited VSI during last three months (October to December, 2020)

Particulars	Total No. of Visitors
October - 2020	
Individual Farmers from Maharashtra, Madhya Pradesh & Karnataka State	318, 03 & 05
November - 2020	
Individual Farmers from Maharashtra & Telangana State	297 & 02
December - 2020	
Individual Farmers from Maharashtra State	320
TOTAL	945



Use of Marcotting Technique in Sugarcane at SBC, Amboli

Dr. RS Hapase
Plant Breeding Section

Vasantdada Sugar Institute, Manjari Bk., Pune

New sugarcane varieties are developed through a conventional breeding program, which depends on the available germplasm stocks for breeding material. The desirable genotypes are used for hybridization to produce new varieties. Sugarcane breeding for improved cultivars is a time-consuming process, taking upwards of ten years from initial crosses to final agronomic assessment of elite cultivars (Cox *et al.* 2000).

Cross pollination is the rule in sugarcane. Self male and female sterility, protogyny and hanging down of anthers away from the stigma at the time of anthesis promote self pollination. Usually anthesis will be in early morning between 5 am and 6 am and maximum anthesis in between 6 am and 8 am. Stigma protrudes out first and anthers dehisce afterwards. Flower opening will be from top to downwards. It will take about 10 days for complete opening of spikelets. Flowering in sugarcane is location specific and influenced by environment. In sugarcane following different crossing techniques were followed to effect the biparental and polycrosses.

Sulfurous acid Technique (Hawaii method)

A sulfurous acid solution keeps the inflorescence alive for several weeks. Here, we cut both male and female flowering arrows along with small portion of stem. During this time, the seed will mature.

Potted Plants

The clones and species not amenable to the sulphuric acid technique or marcotting, clones are grown in small containers which can be readily manipulated for crossing.

Lantern method

This is commonly used everywhere in the world in sugarcane breeding. In this method, providing lantern for a female plant before anthesis starts. From the desired male parent cut the arrow. That arrow can be introduced into the Lantern and shaken up and thereby crossing can be effected. This will

be repeated for 2-3 days in order to have more seed set.

Marcotting method

This method was developed by Venkatraman and Thomas (1926) at Sugarcane Breeding Institute, Coimbatore. In this method a well grown stalks in flag leaf stage as close to the ground as possible in order to insure maximum stalk length. In this technique rooting in canes that would flower later, is induced at the nodal region by covering polythene tube of required size which can covers two to three nodes and a mixture of sand, moist garden soil and organic matter in a suitable proportion is poured around the nodes. The mixture is then watered in adequate quantities and polythene tube will be tied at both the ends also known as sleeving. The sufficient rooting will be after about 15-20 days. The canes are then detached below marcotted portion and kept in pots and made use of in crossing under controlled environment (See Fig. 1.(a-d)).

The Vasantdada Sugar Institute, Pune established a new Sugarcane Breeding Centre at Amboli (Dist.: Sindhudurg) for Maharashtra State during the year 2005 in collaboration with Sugarcane Breeding Institute, Coimbatore. At this station all the above mentioned crossing techniques were used and assessed for their significance over the field crossing. (fig. 2). At this station marcotting technique was undertaken after the natural nuisance in crossing. The following nuisances affecting crossing efficiency were observed at SBC, Amboli;

- a) In early morning due to heavy wind the pollens from open spikelets were flown away.
- b) The high humidity affects the dehiscence of pollens.
- c) The temperature fall in early morning affects opening of spikelet even after heating of male arrows.
- d) Requires every day cutting of male arrows still next seven to eight days



- e) The field crossing method requires more manpower to fix the field structure and pollination in field with the help of ladder.
f) Fertility and seed setting of crosses affected.

Looking to the constraints we started the use of marcotting technique at SBC, Amboli for making crosses from the year 2013 and we got the success. The details of crosses made with the help of this technique and seedlings were raised is given in the following table;

Sr. No.	Year	No. of marcotted canes	No. of bi-parental crosses	Weight of (gm)	No. of seedlings obtained in GN-II (year)
1.	2011	824	116	1608	3564 (2012)
2.	2012	528	189	2635	5884 (2013)
3.	2013	321	70	1671	2863 (2014)
4.	2014	574	115	2231	18579 (2015)
5.	2015	637	102	1848	21135 (2016)
6.	2016	711	89	1110	15279 (2017)
7.	2017	924	78	1707	23683 (2018)
8.	2018	573	80	1748	2753 (2019)
9.	2019	822	202	1988	5102 (2020)
10.	2020	1459	657	Yet to collect fluff	Will be raised in 2021



Fig. 1a :
marcotted canes
in field



Fig. 1b :
marcott
field view



Fig. 1c :
well rotted
marcott



Fig. 1d : Pots with marcotted canes in
hybridization chamber



Fig. 2 : Flowering view of SBC, Amboli

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Genetic Transformation in Sugarcane and Present Status

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Introduction

In agriculture, modern genetic engineering technique called genetically modified crops (GM crops) has modified the genomic DNA of particular plant. The aim in most cases is to insert a new trait to the plant that does not present naturally in the species for example; resistance to certain diseases, pests, herbicide tolerance, environmental conditions, increase of nutritional value etc. More than 189 million hectare of the world's crop lands is planted with GM crops (ISAAA, 2017). India is yet to approve commercial cultivation of GM food crops. Cotton is the only GM cash crop got legal permission for commercial cultivation in India. Recently, GEAC has given a go ahead for tests of GM mustard crop before taking a decision of its commercialization.

The benefits of GM crops are good because of: 1) Better pest and disease resistance, 2) Improved stress tolerance, 3) Faster growth, 4) More nutritious crops, 5) Crop can produce medicines and vaccines, 6) Herbicide tolerance, 7) Better tasting foods etc. On the other side, why GM crops are Bad are: 1) Unexpected side effects, 2) Effects on non-GM Crops, 3) Problems with labeling of GM food, 4) Ecological damage, 5) Reduced species diversity, 6) Over use of herbicides, 7) Benefits may not be available to all. However, there are no scientific data available about the myths of GM crops and most of them are assumptions.

World scenario

Genetic transformation or transgenic technology has been greatly exploited for other food crops species improvement. According to ISAAA-2017 report, ~ 18 million farmers from 26 countries use 185.1 million hectares of land for cultivation of all transgenic crops over a period of two decades. It was 1.7 million hectares in 1996, which counts almost 110-fold increase. During 2015, India was in fourth position with 11.6 million hectares (mha)

Genetic transformation in sugarcane for various traits:

Development of transgenic sugarcane plants is increasing rapidly in recent years. Sugarcane has been genetically modified for traits like sugar yield and quality, novel sugars with potential benefits to consumer and pharmaceuticals. Further, many abiotic and biotic stresses related to physiological characters have been studied. These include resistance to sugarcane mosaic virus (SCMV), yellow leaf virus, sugarcane borer and leaf scald resistance, antibiotic resistance, herbicide tolerance, drought and salinity tolerance.

Production of naturally occurring compounds for use in bioplastics, enhanced nitrogen use efficiency, altered plant growth, improved sucrose accumulation, improved cellulosic ethanol production from sugarcane biomass, enhanced water use efficiency, altered juice colour are the results of transgenic technology. Further, GM sugarcane varieties that can produce high-value compounds e.g., pharmaceutically important proteins, nutraceuticals, biopolymers, enzymes and precursors are paving ways to promoting sugarcane as a biofactory in coming years.

a. Herbicide tolerance: Genetically modified sugarcane plants resistant to phosphinotricine (PPT), the active compound of commercial herbicide, BASTA were generated and transgenic plants were confirmed by Southern blot hybridization. Herbicide resistance gene (*bar*) was used and selected plants were analyzed by PCR.

b. Abiotic Stress tolerance: Higher plants have been genetically transformed for resistance to come herbicides, virus, bacterial and fungal diseases and insect pests, production of enzymes, pharmaceuticals, vaccines etc. However, transgenic sugarcane plants harboring *Grifolafrondosa synthase* gene that improved tolerance to osmotic stress was developed in 2005. Arabidopsis CBF4 gene transferred into sugarcane and it improved drought tolerance. Open



field trials of transgenic sugarcane for PT Perkebunan Nusantara XI (Persero) in Indonesia released drought tolerance only in year 2015. Plant betain aldehyde dehydrogenase (BADHs) an enzyme involved in the production of glycine betain (GB) in response of plants to abiotic stress and potential for transgene expression of BADHt improve abiotic stress tolerance. Likewise, betA and betB (encoding choline dehydrogenase from *Eschericia coli*) and TsVP (encoding V-H+-PPase from *Theilungiella haliphila*) are also responsible for enhancing the abiotic stress tolerance in plants.

Heat shock proteins (HSPs) have a key role in stress tolerance mechanism in plants. HSP70 gene isolated from *Erianthus arundinaceus* and driven by Port Uvi2.3 promoter was introduced in sugarcane variety Co 86032 through *Agrobacterium* mediated method. Their results suggested that EaHSP70 played an important role in sugarcane acclimation to drought and salinity stress and its potential for genetic engineering of sugarcane for developing drought and salinity tolerance.

Introduced the Pea DNA Helicase45 (PDH45) into sugarcane variety Co 86032 through *Agrobacterium* mediated method and analyzed Vo and V1 plants for tolerance to soil moisture and exhibited significantly higher cell membrane thermo-stability, transgene expression, chlorophyll content, relative water content and photosynthetic efficiency. Further, they over-expressed EaDREB2 and pyramiding with the Pea DNA helicase gene (PDH45) in sugarcane cultivar Co 86032 to enhance tolerance to drought and salinity. When co-transformed with plant DNA helicase gene, DREB2 showed greater level of salinity tolerance than in single gene transfer.

c. Biotic Stress resistance/diseases: Diseases and pests cause significant economic losses to the sugar industries throughout the world. Sugarcane is susceptible to a crowd of viral, phytoplasma, bacterial and fungal diseases.

Sugarcane pathogens like mosaic virus and Fiji disease viruses cause significant yield losses in susceptible line. The coat protein-coding region of sugarcane mosaic virus (ScMV) has been introduced in sugarcane. Transgenic sugarcane plants containing this gene were evaluated and exhibited robust resistance over non-transformed plants. Transformed plants were inoculated with ScYLV

and 10 months after infection, 37 plants were negative for ScYLV.

d. Biotic Stress resistance – Insect pests: Pests of sugarcane are another major source of economic damage in all the cane-growing countries. Presently, sugarcane pests such as cane-grubs, borers, mealy bugs, woolly aphids and other insects are controlled by integrated pest management (IPM) practices comprising biological, cultural, and insecticidal controls. Although IPM approaches are complementing the already existing tolerance in sugarcane, increasing pest resistance by means of introducing novel insecticidal genes by transgenic approach would be another technology to support in maximizing and sustaining crop productivity.

In a recent study, genetic transformation in sugarcane with the *Nicotiana alata* proteinase inhibitor gene or snowdrop lectin (GNA) gene exhibited marked antibiosis to canegrubs. In another investigation, observed considerable growth inhibition of sugarcane stalk borers when fed on GM sugarcane engineered with lectin genes. Remarkable resistance to the borer *Diatraea saccharalis* Fab. was also reported in transgenic sugarcane that expressing a Bt[Cry 1A(b)] gene.

Inheritance of resistance to *Bacillus thuringensis* Cry1Ab protein in the sugarcane borer, *Diatraea saccharalis* (*Lepidoptera crambidae*) were analyzed by various genetic crosses. Construction of expression vector of Cry1Ac gene and its transformation in sugarcane and evaluated genetically modified sugarcane lines carrying Cry1Ac gene. Transformations of Cry1Aa3 gene in sugarcane and one-step regeneration of transgenic plants were also reported.

A synthetic gene coding for approtinin, designed and codon optimized for better expression in plant system was transferred to two sugarcane varieties CoC 9206 and Co 86032 through particle bombardment and hygromycin resistant lines were analyzed by in vivo bioassay, in vitro bioassay of Cry1F. Pyramiding of approtinin expressing sugarcane with Cry1Ab for shoot borer resistance was also reported. CTC Brazil has released insect pest resistant Bt sugarcane on commercial basis in 2017.



3.e Genetic Transformation for Byproducts / others: Transgenic plants are contributing in many areas including increased crop production and enhanced food quality in agriculture; production of therapeutic proteins, monoclonal antibodies and edible vaccines for the pharmaceutical industry and environment friendly outputs like biodegradable plastics. The future research may determine that sugarcane is an 'ideal plant biofactory' for many of these new products. Production of pharmaceutical grade proteins in sugarcane, production of Polyhydroxybutyrate (PHB), an environment friendly bio-degradable plastic.

Plastid transformation

Transgene(s) expression into the nuclear genome has led to a growing public distress because of the possibility of gene escape to their wild relative species through pollen. In most of the crops plants, plastids are maternally inherited. Engineering of the plastid genome is gaining importance as an alternative target to nuclear transformation. Chloroplast transformation has got number of advantages over nuclear transformation like: high level of transgene containment, transgene expression and absence of gene silencing. Genetic transformation in plastids (chloroplasts) was attempted in VSI, India and Max Plank Institute of Molecular Plant Physiology, Germany but, no report of development of complete transplastomics.

Genetically modified Sugarcane field trials

PT Perkebunan Nusantara XI (Persero) developed NXI-1T, NXI-4T and NXI-6T, a genetically modified drought tolerant sugarcane variety from BL-19 for drought resistant qualities with the help of CDAST, Jember University, Indonesia. They used *betA* gene of Ajinomoto, Japan which is responsible for accumulation of betain aldehyde dehydrogenase (BADH), as osmoprotectant that helps in developing the drought tolerance. Around 50 hectares of land under cultivation of these varieties.

The Sugarcane Technology Center (Centro de Tecnologia Canavieira- CTC), Brazil has developed the GM sugarcane 'Bt (*Bacillus thuringiensis*)' gene responsible for borer resistance is approved for its commercial cultivation. CTC will work with producers, starting the seedling process and monitoring field planting.

Indian Council of Agricultural Research – Sugarcane Breeding Institute (ICAR-SBI), the Central Government's premier research institution - has joined hands with Vasantdada Sugar Institute (VSI), Pune, for developing drought tolerant genetically modified (GM) sugarcane that will need less water for cultivation. "However, it will be a long-term project. Developing drought tolerant (less water use) GM sugarcane is not an end in itself. We know how difficult it is in India to go for commercial release of any transgenic crop", said an ICAR Scientist. The permission for field trials of drought tolerant GM sugarcane variety, developed by the SBI Coimbatore by over-expressing pea DNA helicase (PDH45), Heat shock protein from *Erianthus* spp. (EaHSP70) and EaDREB2 genes, is under consideration with the Review Committee of Genetic Manipulation (RCGM).

Conclusion

The collaborative research joint venture seeks to make sugarcane production more profitable through cane improvement and industry diversification through the application of biotechnology. Public opinion currently appears to be biased against foods derived from genetically modified (GM) organisms. Lack of knowledge about the process and lack of transparency in introducing genetically modified crops has increased consumers' wariness of these new products. People who supported science and technology and who trusted government and industry were more accepting of the technology.

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Role of Accredited Test Laboratory (ATL) at VSI Pune in Testing and Certification of Tissue Culture Raised Quality Plantlets

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Seed quality is considered as important factor in improvement and attaining higher crop yield and sustained growth in agriculture production. Seed quality is a complex trait and novel research approaches to improve seed quality involve a combination of seed technologies, genetics, and molecular biology. Plant Tissue Culture Technology offers great promise for the production of quality planting material on account of disease free and true to type plants produced through micropropagation techniques. The need for a certification programme for the tissue culture plants is imperative since inadvertent micropropagation of virus infected plants will not only result in its poor performance, but also in undesirable spread of viruses wherever such plants are grown. Also, failure to use prescribed standard protocols will result in variations in the plants produced. The most deleterious variants in tissue culture raised plants are those that effect yield, genetic fidelity/uniformity and carry infection of viruses, and other fastidious pathogens, which are difficult to diagnose. This is an area of great concern, and requires a well-structured system be put in place to provide support to the tissue culture industry for the commercialization of virus free and high quality planting material. The Department of Biotechnology (DBT) is certification agency for tissue culture-raised planting materials and to facilitate it this established a 'National Certification System for Tissue Culture-raised Plants (NCS-TCP)'. NCS-TCP follows a distinct and dynamic quality management system for tissue culture industry encompassing Tissue Culture Certification Agency (DBT), Accreditation Unit (AU) and Project Management Unit (PMU) at Biotech Consortium India Limited (BCIL.). Referral Centres, Accredited Test Laboratories (ATLs), Recognized Tissue Culture Production units.

Accredited Test Laboratories (ATLs)

Test laboratories are accredited entities, responsible for testing the Tissue Culture material for Virus diagnosis and Genetic fidelity/ uniformity, for the purpose of certification. The Test laboratory prepares a Test Report based on tests conducted in conformity with the guidelines. Based on the Test Report, each Accredited Test Laboratory (ATLs) is authorized to issue the Certificate of Quality for the Tissue Culture Plant (CQ-TCP) along with certification label on behalf of the Tissue Culture Certification Agency. ATLs are responsible for maintaining/ procuring all diagnostic kits, primer, probes etc required for routine testing. Each ATL would perform both tests-for virus diagnosis and true-to-type. At present there are 4 ATLs in India viz., Vasantdada Sugar Institute, Pune, GKVK, Bangalore, ICAR-CPRI, Shimla and ICAR.-IISR, Lucknow. At VSI we perform the analysis of stock and batch leaf samples of Banana, Gerbera, Date palm. In this, Virus indexing of Banana for Banana bunchy top virus (BBTV) & Banana streak virus (BSV) using PCR method while Cucumber Mosaic virus (CMV), Banana bract mosaic virus (BBRMV) using ELISA techniques. Genetic fidelity of banana, Date palm assessed through PCR based ISSR marker. In Gerbera only virus indexing for CMV performed analysis through ELISA and phytoplasma detection in date palm using nested PCR.

Banana streak virus (BSV)

Banana streak virus (BSV) is a plant pathogenic badnavirus of the family *Caulimoviridae*, affecting production of banana (*Musa spp.*). It is an unenveloped, non-covalently closed, bacilliform double-stranded DNA (dsDNA) virus with a monopartite genome of ~7.2–7.8kb encoding three open-reading frames (ORFs). ORF1 encodes a small protein of unknown function that is associated with



virions. BSV was first identified in West Africa in 1958 and is now reported in most banana and plantain growing countries. BSV is a complex of different viruses belonging to the pararetroviruses and classified as endogenous pararetroviruses when they are integrated into a host genome. The BSV integrated in the banana host genome are known as endogenous BSV (eBSV).

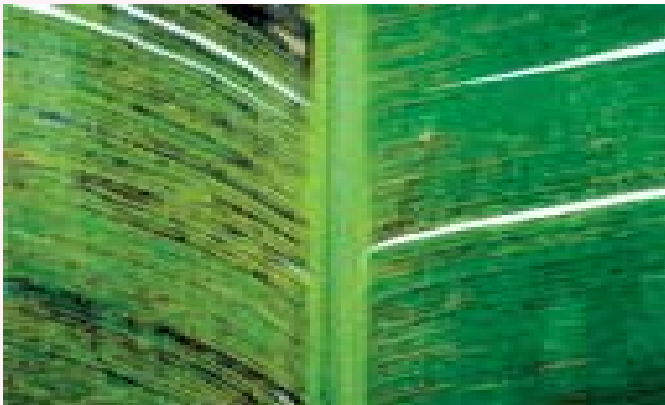


Fig.1 : Banana Streak Virus infected to banana plant

Most common symptoms are narrow, discontinuous and sometimes continuous chlorotic or yellow streaks that run from the leaf midrib to the margin. In some cases, spindle or eye-shaped patterns are present. Yellow blotches have also been associated with banana streak. Symptoms can be sparse or concentrated. Sometimes the lamina can be distorted. Streaks later darken to orange and often become brown or black. Necrosis has also been seen on the midrib and petiole. Necrosis occurs more under low temperature, short-day conditions. A characteristic of infection is the periodicity of symptom expression in leaves. Plants may not show streak symptoms in all leaves and, for several months at a time, emerging leaves may be symptomless or show only slight symptoms. Symptom expression seems to be associated with the change of seasons and fluctuating temperatures may play a role. Plants with BSD may appear symptomless at some stage in their growth cycle as leaves with symptoms are shed and new leaves appear without symptoms due to factors discussed above. Some infected land races show no symptoms even under fluctuating environmental conditions.

Banana Bunchy Top Virus (BBTV)

The disease, often called BBTV for banana bunchy top disease, gets its name from the bunchy appearance of infected plants. By that time, however, the virus has most likely been spread to other plants by the banana aphid, *Pentalonia nigronervosa*. Infected plants cannot recover and will serve as a source of viral particles unless they are destroyed. The virus is also spread through infected planting material. Bunchy top is considered to be the most devastating viral disease affecting bananas.



Fig. 2. Banana Bunchy Top Virus infected to banana plant.

Bunchy top is named after one of the most characteristic symptoms of an advanced infection, when the leaves become progressively dwarfed, upright and bunched at the top of the plant, with wavy and chlorotic margins that tend to turn necrotic. Initial symptoms may be difficult to detect for a novice due to their inconspicuous nature. The first symptoms are dark green streaks on the lower portion of the leaf's midrib and later on the secondary veins. Removing the waxy white coating on the midrib makes it easier to see the streaking. The streaks consist of dot-dash patterns, the so-called 'Morse code', the most diagnostic symptom of bunchy top. As infection progresses, streak symptoms become more evident on the leaf blade. Dark-green hook-like extensions of the veins can also be seen in the narrow, light-green zone between the midrib and the lamina. The short hooks point down along the midrib toward the petiole. These hooks are best observed from the underside of the leaf by holding the leaf to the light.



Cucumber mosaic virus (CMV)

The disease, cucumber mosaic, is caused by the Cucumber mosaic virus (CMV). CMV is one of the most common and destructive cucurbit viruses, and it is widely distributed throughout temperate and tropical areas of the world. CMV can infect over 1200 plant species including both monocots and dicots. There are many strains of CMV that differ in the symptoms they cause, the range of hosts they infect, and their means of dispersal. It can be transmitted from plant to plant both mechanically by sap and by aphids in a stylet-borne fashion. It can also be transmitted in seeds and by the parasitic weeds, *Cuscuta sp.* Mosaic of infectious chlorosis of banana has been known for a long time to be caused by Cucumber Mosaic virus (CMV), and occurs throughout the world. Symptoms consist of foliar mosaic and occasional leaf deformation, especially in young suckers developing from infected mother plants. Mosaic symptoms are most pronounced during cool weather but do not persist, in contrast, the severe of heart rot strains of CMV. CMV occurs naturally on very wide range of plant species, including cultivated crops (e.g. tomato, pepper, cucurbits) and weeds, which serve as reservoirs of infection for banana. The virus is transmitted in a non-persistent manner by several aphid species (e.g. *Aphis gossypii*, *Myzus persicae*) which colonize a wide range of source plant species and visit but do not colonize banana. As a result, infection of banana CMV occurs almost exclusive by aphid transmission from other plant species rather than from banana to banana.



Fig.3. : Cucumber Mosaic Virus infected to banana plant.

Banana bract mosaic virus (BBrMV)

Bract mosaic caused by banana bract mosaic virus (BBrMV) was first recorded in the Phillipines in 1979. The virus is known to infect only banana, and can be transmitted in a non-persistent manner by at least three species of aphid, *Aphis gossypii*, *Rhopalosiphum maidis* and *Pentalonia nigronervous*. Infection by BBrMV can result in growth defects, reduced suckering and misshapen, unmarketable fruit; therefore this disease has the potential to cause economic loss. Fortunately, BBrMV like BBTV is not known to occur in the new world tropics and has been identified only in the Phillipines, India, Sri Lanka, Vietnam and Western Samoa. This disease would therefore be most effectively controlled by exclusion. As in the case of BBTV, attention must be paid to the source of imported banana planting material particularly plants produced by in vitro propagation. Routine indexing of germplasm for BBrMV infection can be reliable by enzyme immunoassay or RT-PCR.



Fig.4. : Banana bract mosaic virus infected to banana plant.

Cucumber mosaic virus (CMV) in Gerbera

Gerbera has gained immense popularity in the past few years in India. The demand of gerbera, in Indian floral industry, is increasing day by day as cut flower and potted plant due to its beautiful blooms of various colors, long vase life and ability to rehydrate after long transportation. The gerbera production has setback of plant virus infections: CMV, Impatiens

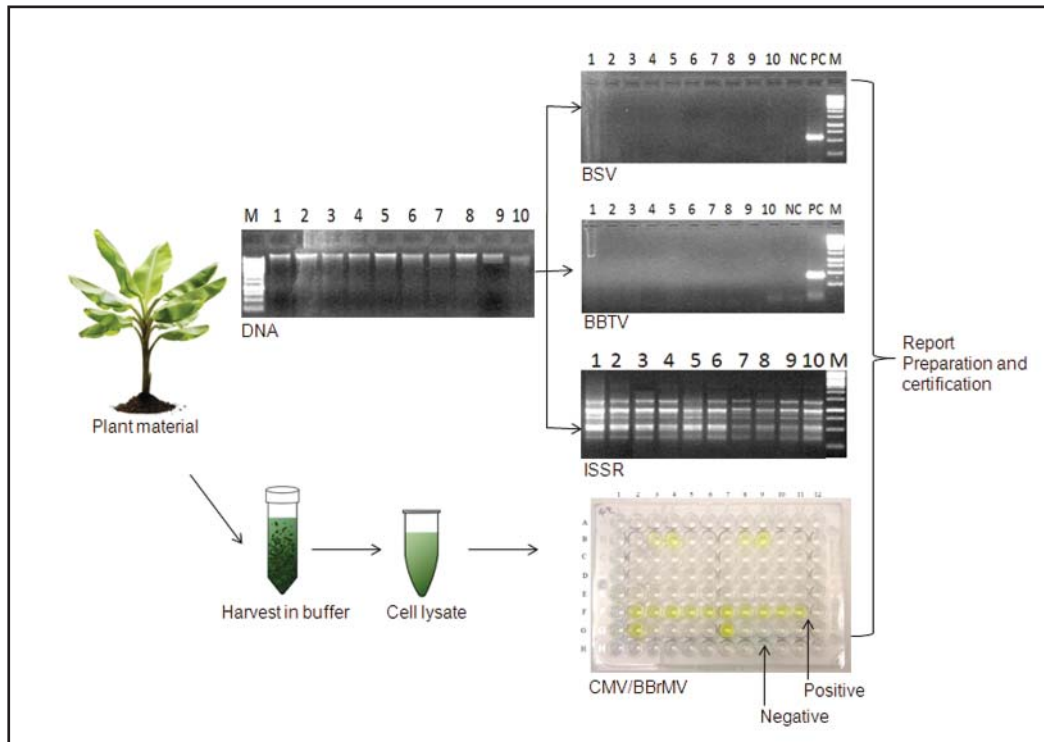


Fig.5 : Diagrammatic illustration of plant sample analysis under NCS-TCP program

nercot spot virus (TSWV), Tobacco mosaic virus (TMV) and Tobacco rattle virus (TRV). Amongst them, CMV is considered as important because it caused severe flower deformation so it leads to deterioration in the market value of their blooms. Gerbera is propagated by vegetative means through clumps and hence chances are more for viral dissemination to their subsequent generation and from one area to another cultivation site, therefore virus elimination from mother stock was considered for its better quality production. For this we are using ELISA techniques to detect this virus.

Phytoplasma in Date Palm

Phytoplasmas (*Candidatus Phytoplasma*) are unculturable, cell wall-less bacteria that are taxonomically classified as class Mollicutes and plant pathogens that have been associated with economically and ecologically important plant hosts worldwide. Phytoplasmas are classified into groups and subgroups based on restriction fragment length polymorphism (RFLP) analysis of their 16S rRNA-encoding loci with a set of seventeen endonucleases. The main symptom observed in the plants was

discoloration of the foliage, which developed from the tip to the base of the leaves. The leaves showed yellowing followed by dryness and most fruits fell early, particularly in the Sukkari cultivar. They are transmitted by phloem-sucking insects in the family's Cicadellidae, Cixiidae, Cercopidae, Derbidae, Delphacidae and Psyllidae. Phytoplasma is obligate parasite of phloem tissue and affects many plants mainly date palms. For detection of phytoplasma, Nested PCR was used in which two sets of 16SrRNA phytoplasma gene specific primers were used in two rounds of PCR. The first round of PCR was set with first set of primers and the annealing was done at 55°C. For the second round PCR, first round amplification used as template. The nested second round primer amplifies the 16SrRNA gene with the target size.

For More information visit to following website
URL: <https://dbtncstcp.nic.in/>



Natioanl Certification System for Tissue Culture Raised Plants (NCS-TCP)



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