



Research

Highlights

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Sugarcane Breeding Institute

(Indian Council of Agricultural Research)

Coimbatore - 641 007, India

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Preface

I have a great pleasure in presenting the Research Highlights of the Institute for the year 2008-09.

The institute made significant achievements in varietal development during 2008-09 by releasing six improved sugarcane varieties for the different agro climatic zones of the country. The Central sub-committee on crop standards, notification and release of varieties for agricultural crops approved the release of Co 2001-13 and Co 2001-15 for the peninsular zone, Co 0238 and Co 0118 for North western zone and Co 0232 and Co 0233 for the North central zone. These varieties performed better than the existing varieties with reference to yield and quality and topped in most of the trials conducted under the AICRF(S). Apart from high yield and quality, these varieties also possess tolerance to drought and water logging and resistance to red rot. These new varieties are expected to fulfil the sugarcane varietal needs of the three major agro climatic zones in the country.

A germplasm exploration was conducted in the state of Rajasthan for the first time for the collection of *Saccharum germplasm*. The accessions collected are potential sources for drought tolerance and thus have significance in breeding sugarcane varieties for drought resistance. Further gains were made in the areas of genetic transformation with the developments of several sugarcane transgenics through particle bombardment and *Agrobacterium* mediated genetic transformation. The bioassay studies showed that transgenics incorporating Cry1Ab gene have potential in the management of borer pests.

Micro irrigation studies showed that 40-50 % saving of irrigation water and 25 % saving in N & K fertilizer could be achieved through micro irrigation and fertigation without compromising on yield. Appropriate packages for weed

management and flowering control have also been developed.

Results obtained on the chemical management of red rot were promising. New fungicides that can control primary infection of red rot have been identified. Wilt could be artificially reproduced which will now facilitate screening of sugarcane varieties and germplasm for wilt resistance.

Various outreach programmes were conducted to popularize the varieties and technologies developed at the institute. Besides, a number of training programmes were also organized for the benefit of sugarcane growers and development workers. The institute also successfully organized the 40th Sugarcane R & D workers meeting of Tamil Nadu at Salem.

The major research achievements and activities of the institute for 2008-09 have been presented in the publication. I thank all the Scientists and staff of the Institute who had contributed to the research activities of the Institute during the year. The support and encouragement received from Dr. Mangala Rai, Secretary, DARE and Director General, ICAR, Deputy Director General (Crop Science) and Dr. K.C. Jain Assistant Director General (CC) are duly acknowledged.

(N. VIJAYAN NAIR)
DIRECTOR

Contents

• Crop Improvement

• Crop Production

• Crop Protection

• Outreach

• Miscellaneous



Crop Improvement

New Early High Sugar Varieties Released for Sub-tropical India

Two early maturing varieties, Co 0118 (Karan2) and Co 0238, developed at Sugarcane Breeding Institute Regional Centre, Karnal were recommended for release for commercial cultivation in North Western Zone by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops in 2009. These varieties are suitable as substitutes for CoJ 64.

Co 0118 (Karan 2) is a selection from the progeny of Co 8347 x Co 86011. In AICRP trials, this variety showed 15 % improvement in cane yield and 3 % improvement in sucrose percentage in juice compared to the check variety CoJ 64. The jaggery of this clone is of A₁ quality with light yellow colour and the fibre % is about 12.78. It had medium thick,



Co 0118

green-yellow canes with obconoidal internodes, rectangular buds, lanceolate auricle on both sides (generally long on one side), shallow bud groove and weak spines on leaf sheath.

The cane is free from splits and pith. This clone is moderately resistant to the prevalent races of red rot pathogen.

Comparison of Co 0118 and Co 0238 with standards in AICRP trials

Character	Co 0118	Co 0238	CoJ 64	CoPant 84211
Cane yield (t/ha)	78.20	81.08	67.59	66.84
Sugar yield (t/ha)	9.88	9.95	8.59	8.28
Sucrose %	18.45	17.99	17.90	17.65

Co 0238 is a selection from the progeny of CoLk 8102 x Co 775. In comparison to CoJ 64, it showed about 20 %, 16 % and 0.50 % improvement in cane yield, sugar yield and sucrose % in juice, respectively. The jaggery is of A₁ quality with light yellow colour. This variety is suitable for harvesting during winter as it gives good ratoon crop when harvested during winter. The cane yield and sugar yield of Co 0238 (photo overleaf) was higher than that of CoJ 64. It had medium thick green yellow canes with cylindrical internodes, pentagonal buds, deltoid auricle and shallow bud groove. This clone is free from splits, spines on leaf sheath and pith. The fibre % is about 13.05. This clone is moderately resistant to the prevalent races of red rot. These two new varieties are expected to provide a significant boost to sugarcane productivity and sugar recovery in the region.



Co 0238

Co 0232, a reddish purple early maturing, water logging tolerant and red rot resistant clone is a clonal selection from the cross CoLk 8102 x Co 87267. It recorded 67.82 t/ha of cane yield, 7.83 t/ha of CCS and 16.51 % of sucrose at 300 days, with 7.63 %, 10.55 % and 0.77 % improvement respectively for these characters over the popular early variety in North Central Zone, CoSe 95422. This variety is moderately resistant to red rot and moderately tolerant to top borer. Less number of aerial roots, non-lodging and retention of green leaf canopy are the desirable characteristics of this clone for cultivation under water logging condition. Even after three months of water logging the leaf canopy remains green with no leaf drying and reduction in number of green leaves. High tillering/sprouting ability of the Co 0232 compensates the tiller mortality during the early drought and late water logging condition. The cane has no splits and leaf clasping is very loose enabling easy detashing. This clone was recommended for cultivation in the North Central and North East zones comprising Eastern Uttar Pradesh, Bihar, West Bengal and North Eastern states.

Co 0233, a midlate maturing, high yielding, water logging tolerant and red rot resistant clone is a selection from the cross CoLk 8102 x Co 775. Co 0233 recorded high cane yield of 67.77 t/ha compared to 55.96 t/ha of the best standard CoSe 92423, in AICRP trials. It also recorded high CCS t/ha (8.25) and sucrose % (17.54). Being tolerant to water logging, this variety had 14.91 % higher cane yield and 12.14 % higher CCS t/ha than the standard variety BO 91, under water logged

New sugarcane varieties for Bihar and Eastern U.P

Two new varieties from the Institute were recommended for release in 2009 for commercial cultivation in Bihar and Eastern Uttar Pradesh by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops.



Co 0232



Co 0233

condition. The clone was resistant to red rot under nodal method of inoculation and R and MR under plug method of testing. It is resistant to smut and moderately tolerant to top borer. It is also non-lodging and non-flowering. No split is present in the cane. Co 0233 has a purple with green tinge cane colour, dark green dewlap, cylindrical internode and ligular process present. This clone was recommended for cultivation in the North Central and North East zones comprising Eastern Uttar Pradesh, Bihar, West Bengal and North Eastern regions. Both these varieties are very promising in view of the high yield and quality potential, besides resistance to red rot and water logging.

'Co' canes of 2009 series

During 2008-2009, 22 'Co' canes comprising nine early and 13 midlate clones were identified based on trials conducted at Coimbatore and Karnal. In the early group at Coimbatore, Co 09006 recorded the highest CCS (18.01 t/ha) and cane yield (123.33 t/ha) and was significantly superior to the best standard CoC 671 (14.28 t/ha). Seven clones (Co 09001, Co 09002, Co 09003, Co 09004, Co 09005, Co 09006 and Co 09007) were significantly superior to the standards for cane yield. In the midlate set, seven 'Co' canes viz., Co 09009, Co 09012, Co 09013, Co 09016, Co 09017, Co 09018 and Co 09019 had superior performance than Co 86032 for CCS t/ha and cane yield. Two clones Co 09010 and Co 09014 were significantly superior for cane yield compared to the standard Co 86032.

Three subtropical clones (one early and two midlate) were identified from Karnal. In the early group Co 09020 (68.67 t/ha) recorded significantly higher cane yield than CoJ 64 and CoPant 84211. Both the midlate clones Co 09021 (98.78 t/ha) and Co 09022 (83.03 t/ha) were significantly superior for yield in comparison with the check varieties Co 1148 and CoS 767.

Genetic Resources

Collection of wild *Saccharum* germplasm from Rajasthan

An exploration was organized in Rajasthan state during October – November 2008 for the collection of wild *Saccharum* germplasm. Very few accessions from Rajasthan exist in the present germplasm collection. While no distribution of *S. spontaneum* was observed in the arid region, limited collections could be made in Southern and Eastern Rajasthan. Some of the types were collected from very dry regions growing on the pure sandy desert soil hence the possibility of their carrying drought tolerant genes cannot be ruled out. *Erianthus bengalensis* occurred commonly on the bunds or wastelands in many parts of East Rajasthan. *E. arundinaceus* was not present in the areas surveyed. A total of 14 accessions of *S. spontaneum* were collected from 10 districts of eastern and southern Rajasthan.



Germplasm collection from sandy desert soil in Rajasthan

World collection of sugarcane germplasm

The world collection of sugarcane germplasm comprising 1806 clones and Indian germplasm collection of 1562 accessions were maintained in the field gene bank clonally. The collections are being constantly monitored for the incidence of diseases and pests. One recently introduced foreign hybrid clone from USA was quarantined for one year and planted for field maintenance. Species germplasm was screened for red rot resistance. *S. barberi* clones showed high percentage red rot resistance (38.1%) followed by *S. sinense* (13.3%) and *S. robustum* (4.9%) while *S. officinarum* clones recorded least level resistance (3.4%). *Erianthus arundinaceus* showed high percentage of red rot resistant clones (88.1%). In evaluation for smut resistance *S. sinense* clones showed higher percentage of resistant clones (78.0%) followed by *S. barberi* (33.3%) and *S. robustum* (34.6%). As in red rot the *S. officinarum* clones showed low percentage of smut resistant clones (8.8%). To backup the field maintenance, *in vitro* conservation of sugarcane germplasm was initiated. Shoot tips from 24 *S. officinarum* clones are under *in vitro* multiplication.



A view of the field gene bank at Kannur

Germplasm Registered

Co 97016 (IC565018) has been registered as sugarcane germplasm with NBPGR, New Delhi (Registration number : INGR09052). It is novel and distinct based on – i) a rare recombinant of commercial value involving the wild species *Saccharum robustum*, and ii) Combining high cane yield and sugar yield with tolerance to waterlogging, salinity and drought stresses under sub-tropical conditions of India.

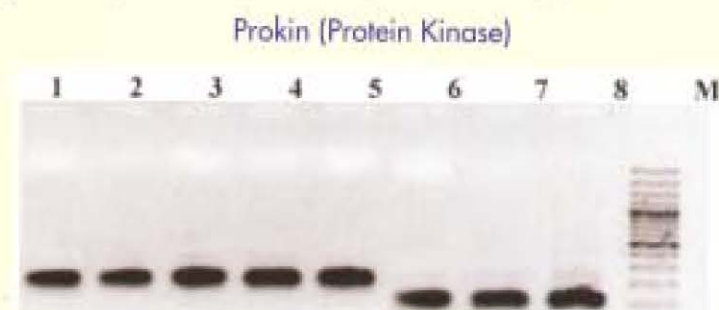
Biotechnology

Candidate genes for drought resistance

The mapping population of Co 740 x Co 775 was categorized as susceptible (23%), moderately susceptible (33%), moderately resistant (20%), resistant (14%) and tolerant (11%) based on cane yield and quality characters, and physiological parameters after imposition of drought during the formative phase. Polymorphism between drought resistant

and susceptible clones has been observed in RT-PCR analysis.

The candidate gene IGS, Nit, cAPX, DHAR, prokin, PIN1 and SOD gave resistant specific amplification while GST 1 gave two specific bands in the susceptible parent and progeny. SOD gene showed 98% homology with the drought inducible protein in *Saccharum* hybrid. The IGS gene showed 95 % homology with rice genomic DNA and 80% homology with hypothetical proteins expressed in rice genome.

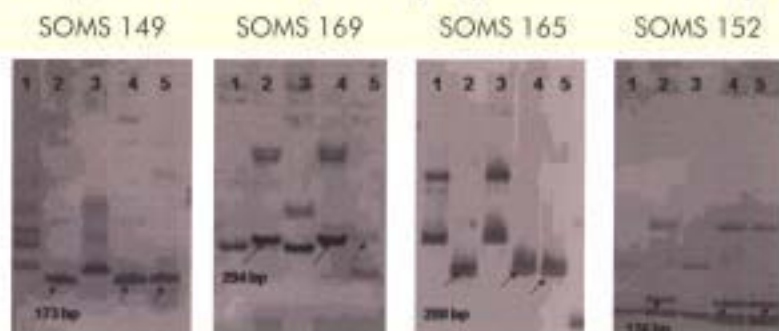


1-- Co 740 R Parent 2-5 -- Resistant (R) Progeny (5,20,30,52) 6-- Susceptible (S) Parent Co 775 7 -8-- S Progeny (440) M - 100 bp DNA ladder

Identification of *Erianthus* specific markers

Three *Erianthus* clones namely Eri-2385, IK76-93 and IK76-91 along with one *S. officinarum* clone DB95-918 and one *S. robustum* clone PIR98-635 were screened with 72 sugarcane microsatellite primers, one Sorghum microsatellite primer, one 5s rDNA primer and one ITS primer to identify *Erianthus*-specific markers. A total of 698 fragments were amplified by the 75 primers of which 458 were polymorphic. Twenty-seven of the sugarcane microsatellite primers amplified 78 *Erianthus*-specific fragments that were absent in *S. officinarum* and *S. robustum*. The *Erianthus*-specific markers amplified were in the size range of 27 bp to 1241 bp. The primers SOMS152 and SOMS129 amplified the maximum number of six *Erianthus*-specific fragments each while the Sorghum microsatellite primer Sb6-84 amplified one marker of 140 bp size specific to *Erianthus*. The 5srDNA primer amplified a total of five polymorphic fragments including one *Erianthus* specific marker of size 370 bp. The ITS II primer amplified one *Erianthus* specific marker of 400 bp in size. These markers will be useful in identifying true hybrids among the progenies of crosses involving *Erianthus* spp.

Erianthus specific markers amplified by sugarcane microsatellite primers



Erianthus-specific markers Lane 1 - *S. officinarum*, 2 - Eri-2385 (*Erianthus*), 3 - *S. robustum*, 4 - IK-76-91 (*Erianthus*), 5 - IK-76-91 (*Erianthus*)

Transgenic Research

In vivo bioassay of transgenics against shoot borer

Thirty nine transgenics of the varieties Co 86032 and CoJ 64 with cry 1 Ab alone or with both cry 1 Ab and Aprotinin genes were bioassayed against shoot borer using neonate carrier under green house conditions. cry 1 Ab expression in these plants were demonstrated previously through western analysis and the toxin was quantified using ELISA.

The transgenics produced considerable lower percentage of deadhearts compared to the untransformed control plants despite suffering feeding damage by the borer. Transgenics produced through particle bombardment or *Agrobacterium* mediated transformation did not differ in the extent of shoot borer damage, despite higher expression of Cry1Ab in the latter method. Reduction in borer damage in aprotinin-expressing sugarcane pyramided with cry1Ab indicated compatibility of the two genes. Expressed Cry1Ab content was negatively related to deadheart damage caused by the borer in some groups of transgenics.

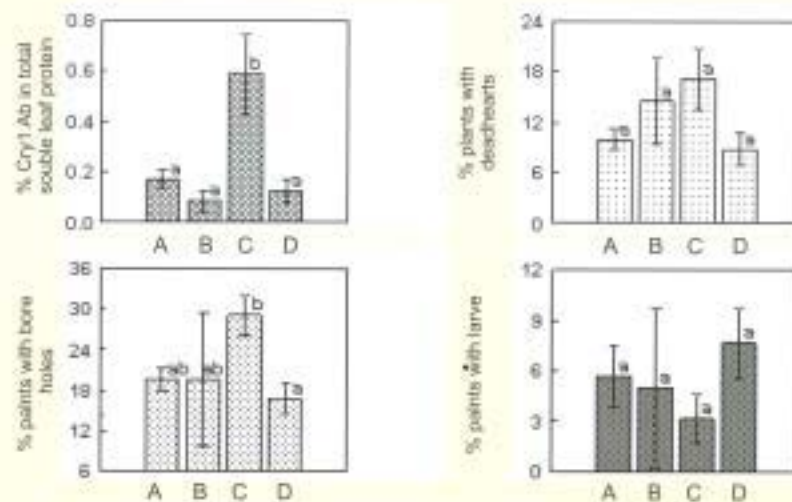


I: Transgenic plant;

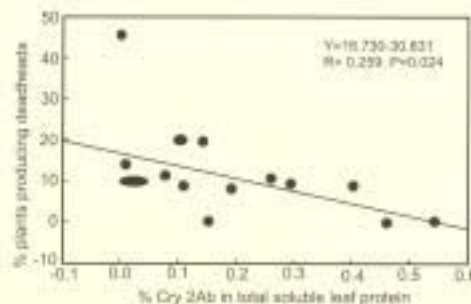
II: Untransformed control plant

Estimation of BT toxin in transgenic sugarcane with cry1Ab gene

Cry1Ab protein estimated in 28 progenies of transgenic CoJ 64 x untransformed Co 775 varied from 0.17% to 1.16% of the total soluble leaf protein whereas in the transgenic CoJ 64 it was 0.13%. In an independent estimation, Cry1Ab content was almost same in leaf and root whereas in stem there was a reduction of almost 50%.



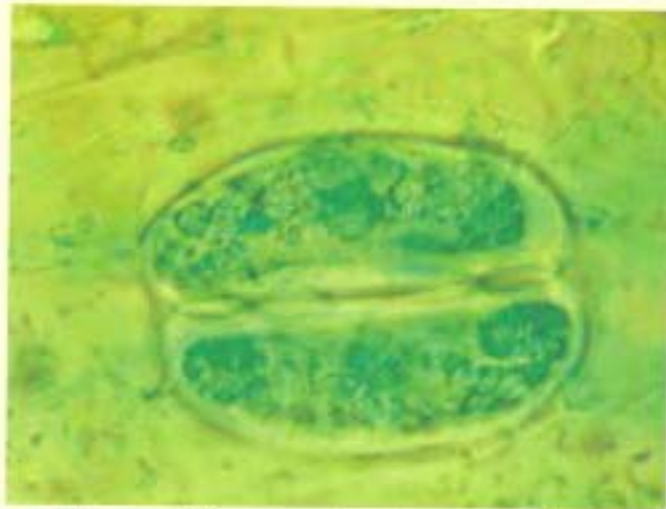
Expression of Cry1Ab toxin and damage parameters of shoot borer (*Chilo infuscatellus*) in various groups of sugarcane transgenics: (A) transgenics of the cultivar Co 86032 produced through particle bombardment; (B) transgenics of the cultivar CoJ 64 produced through particle bombardment; (C) transgenics of the cultivar Co 86032 produced through *Agrobacterium* mediated transformation; (D) transgenic expressing aprotinin (Co 86032) pyramided with cry1Ab through particle bombardment. Bars represent mean \pm SE of various transformants in each group. Bars with the same letter are not significantly different ($P > 0.05$) by ANOVA and DMRT of square root transformed values.



Correlation between percent Cry1Ab content in total soluble leaf protein and percent plants producing shoot borer (*Chilo infuscatellus*) deadhearts in transgenics of sugarcane cultivar Co 86032 transformed through particle bombardment

Cloning and tissue specific expression studies of a new promoter

Upstream of one of the *ubi* genes with 1929 bp was cloned and sequenced. Analysis of the sequence data has shown that the immediate upstream of the start codon of the gene has introns and exons consisting of 1653 bp and 37 bp of leader sequence. Above it is the promoter sequence of 239 bp. The promoter sequence has the promoter elements - TATA box and CAT box - and also *cis* activating sites for root, guard cell and xylem specific expression. For validation studies tobacco were transformed with the pCAMBIA 1305, where *gus* gene is driven by the new promoter. In tobacco, some tissue specific expression (guard cells, xylem and root) of the *gus* gene was observed



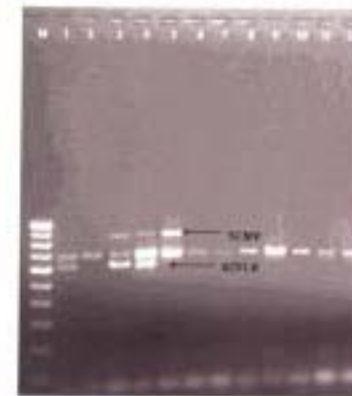
Tissue specific expression of *gus* gene driven by new promoter in tobacco guard cells.

Molecular diagnosis of sugarcane viruses

A multiplex reverse transcription polymerase chain reaction (M-RT-PCR) was developed for the detection of sugarcane mosaic virus (SCMV), sugarcane streak mosaic virus (SCSMV) and sugarcane yellow leaf virus (SCYLV), three of the major RNA viruses widely prevailing in the sugarcane growing regions around the world. Primers designed from the coat protein genes of the respective viruses amplified fragments of -860 bp (SCMV), -690 bp (SCSMV) and 615 bp (SCYLV) in M-RT-PCR. In this study we could

specifically detect the target viruses in disease suspected sugarcane cultivars. Out of nine samples four were found infected with all the three targeted viruses, two had infections of SCMV and SCSMV and the remaining three samples had the viruses found separately (See photo). The sequence information of the M-RT-PCR products has confirmed their authenticity of the respective viruses. Furthermore, Multiplex-RT-PCR was found to be equally efficient to uniplex RT-PCR to amplify the target viruses from sugarcane. This is the first report on detecting three viruses together in a single PCR reaction in sugarcane and this will have immense application in sugarcane quarantine programmes.

Detection of three major RNA viruses in sugarcane using multiplex reverse transcription polymerase chain reaction (M-RT-PCR)



Lanes M. 100 pb DNA size marker,
 1. Co 6304, 2. CoC 671 (glass house),
 3. CoV 94101, 4. Co 86010,
 5. CoA 7701, 6. Co 86032,
 7. Co 94008, 8. CoJ 65; 9. CP 52-68;
 10. Co Pant 84211, 11 Co 7218, 12. BO 54

Molecular variation in red rot pathogen

Molecular variability based on 5.8s-ITS in *C. falcatum* distinguished 80 isolates into three different groups. The first group had homogenous population of tropical pathotypes with high virulence, the second had heterogenous population from tropical and sub-tropical regions and the third group had isolates of dark coloured, non-sporulating least virulent ones.

Molecular basis of red rot resistance in sugarcane

After DD-RT-PCR analysis potential defense related transcripts were selected for RACE analysis to clone the full length cDNAs. Compatible primers

were designed at the 3' end using the available partial sequence information and used in the RACE protocol. Using RNA ligase mediated – RACE, full length sequences of 14-3-3 like protein, chitinase, xylanase inhibitor and basal antifungal peptide were isolated.

In bioinformatic analysis it was found that the chitinase isolated from sugarcane belongs to class IV chitinase and 3-D structure of the protein was constructed. Similarly characterization of 14-3-3 like protein revealed the presence of conserved 14-3-3 superfamily domain, 5'UTR (1-86bp), ORF (87-857 bp) and 3'UTR (858-1094 bp) in the full length sequence of 1094 bp. The 14-3-3 homologues are known to mediate signal transduction and interact with MEK kinases.

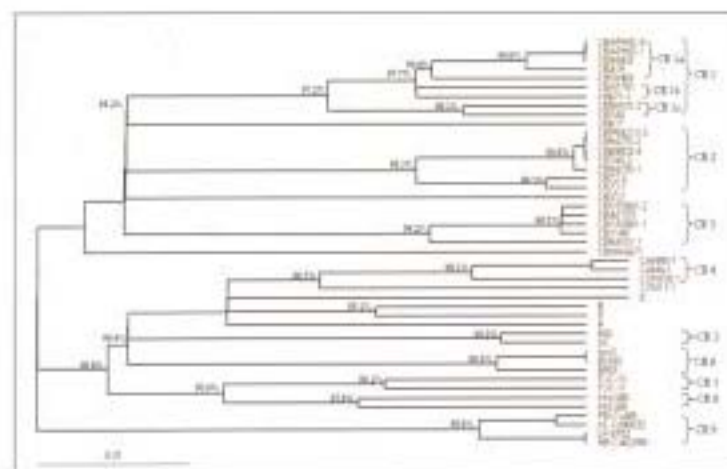
In 2-dimensional gel electrophoresis, TCA/acetone precipitation-LBT and phenol extraction methods were found to be the most suitable for producing high number of good quality spots and reproducibility to study sugarcane proteome. After eLD-IT-TOF-MS/MS analysis a reference map has been established for sugarcane stalk tissue proteome with 30 protein spots commonly present in LB, LBT and phenol methods.

Molecular variation in sugarcane viruses

Detailed characterization of sugarcane mosaic virus (SCMV) from India revealed that our isolates do not share close homology with established type strains SCMV-A, B, D,E and SC reported from other countries. We have grouped Indian SCMV isolates into nine new SCMV strains and occurrence of these strains in other parts of the world is not known.

Characterization of 22 new sugarcane yellow leaf virus (SCYLV) from India based on coat protein sequencing established the occurrence of three SCYLV genotypes viz., CUB, IND and BRA-PER in India. Among them SCYLV-IND is found only in India and the other two genotypes are reported from other countries.

A 97.0% sequence identity limit and position in the phylogenetic tree was used to assign the virus isolates to different phylogenetic groups. The percentage value behind each node represents the nucleotide sequence identities among the sequences assembled under a node. The scale bar indicates the number of substitution per site.



Phylogenetic relatedness of Indian SCMV isolates with the SCMV type strain/ strains and other SCMV isolates from sugarcane reported from world wide (core region)

Research highlights of 1924-25

Control of Male fertility in Sugarcane arrows

"Persistent attempts were made to try and influence the fertility of the anthers in an arrow by suitable manipulations.....After experimenting in various directions, it was found that cane arrows could be partially fed on special solutions, by separating vertically a tongue of cane a good distance below the arrow, and inserting the free half in to the solutions. Micro chemical tests showed that the solutions reached to the top portions of the arrow in less than 12 hours..."



Crop Production

Varieties for multi-ratooning

Fourteen varieties were evaluated for their multiratoon performance at Ugar Sugars, Belgaum District, Karnataka. In the III ratoon crop of First cycle, there were no significant differences in cane yield among the varieties though large numerical differences were observed. The highest cane yield was recorded in Co 86032 (112.4 t/ha) followed by Co 0209 (105.1 t/ha), Co 0217 (104.0 t/ha), Co 85019 (94.3 t/ha) and CoC 671 (94.3 t/ha). Juice sucrose per cent also did not vary significantly among the varieties. Varieties Co 94012 (19.36), CoC 671 (18.86), Co 86032 (18.70) had higher sucrose per cent than the other varieties. In the II ratoon crop of Second cycle, significant varietal differences in cane yields were observed. Variety Co 0217 recorded the highest cane yield (97.6 t/ha) followed by Co 86032 (87.9 t/ha), which were on par. Co 97008 and Co 91010 were the other two varieties which had better ratoon yields. These four varieties were better than CoC 671 (64.6 t/ha.), the ruling variety of the area. Varieties also differed significantly in sucrose per cent. Co C 671 recorded the highest sucrose in juice (19.26%) followed by Co 94012 and Co 88025.



Co 91010

Cynodon and nutgrass management in sugarcane

Different combinations of weed control practices for their efficiency to manage weeds viz., *Cynodon* and nutgrass in sugarcane based cropping systems were assessed. Different pre-planting weed control practices and in-crop weed control practices were evaluated. The results indicated that pre-planting weed control using 'glyphosate' followed by in-crop weed control with 'pre-emergence atrazine' and 'post emergence ethoxysulfuron' or 'directed post emergence paraquat or glyphosate' is useful to manage weeds including *Cynodon* and nutgrass which are persistent in nature, in both plant and ratoon sugarcane. When cotton was raised as rotational crop, pre-planting weed control using 'glyphosate' followed by in-crop weed control with 'pre-emergence pendimethalin' and 'post emergence ethoxysulfuron' was found suitable.



Cynodon infested sugarcane field



Nutgrass infested sugarcane field

Micro irrigation in ratoon sugarcane

Amount of water saved through drip irrigation combined with planting method and fertigation on ratoon cane yield was evaluated. The experiment consisted of six drip irrigated treatments, which are a combination of planting methods and fertigation levels compared to a control. The treatments are T_1 - Furrow irrigation + soil application of 100% recommended dose of fertilizers (RDF- control); T_2 - Paired row planting + fertigation @ 100% RDF; T_3 - Paired row planting + fertigation @ 75% RDF; T_4 - Trench planting + fertigation @ 100% RDF; T_5 - Trench planting + fertigation @ 75% RDF; T_6 - Pit planting + fertigation @ 100% RDF; T_7 - Pit planting + fertigation @ 75% RDF.

NMC per ha was found to be the highest with surface irrigated plot followed by paired row planting, pit planting and trench planting. However, the count did not vary significantly between the surface irrigated plots and that of paired rows with fertigation at either level. Trench planting recorded the lowest NMC. The other cane yield parameters like cane weight, cane girth and length or internode number and length failed to respond to the treatments imposed.

Yield data showed that paired row planting with fertigation at either levels (100 & 75 % RDF) performed well (108.0 and 111.7 t/ha) and was on par with surface irrigated crop (111.3 t/ha) as also with pit planting with fertigation at 75 % RDF (102.3 t/ha). The performance of trench planting was the least compared to the other planting methods. The average brix of crop that was drip irrigated was 22.0 and sucrose was 19.5% while for surface irrigated crop the corresponding values were 21.7 and 19.6%. Analysis of juice quality data revealed that the quality remained unaffected by the method of irrigation or planting under drip. In all the three methods of planting under drip irrigation, fertigation using 75% of the recommended dose was found to yield on par with fertigation using 100% fertilizer dose. In the first ratoon crop, 2756.6 mm water was used for crop growth in surface irrigated plots as compared to 1323.5 mm water in drip irrigated plots.



Drip irrigated ratoon sugarcane

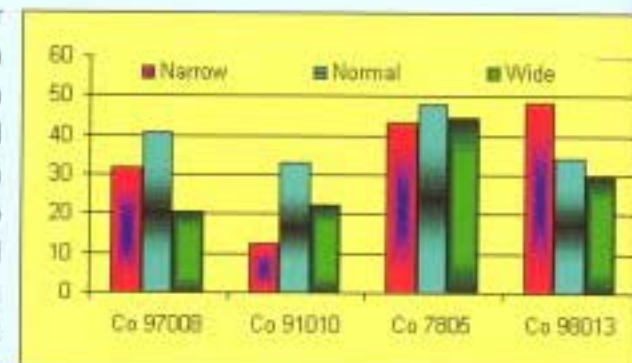


Surface irrigated sugarcane crop

Studies on tiller mortality and means of improving tiller survival in sugarcane

Tiller mortality in sugarcane was studied in different varieties planted at different spacings. The tiller population recorded was highest at 120 days of crop age and under narrow spacing.

At 120 days (T_{120}) the tiller population ranged from 74,811/ha (Co 7805) to 90,000 (Co 91010) in wide row, while in normal and narrow spacings it ranged from 116,660/ha (Co 97008) to 140,740/ha (Co 7805) and 146,666/ha (Co 7805) to 162,955/ha (Co 97008). Tiller mortality was least under wide row (35.4% genotypic mean) while under normal and narrow spacing the tiller mortality were 53 and 54% respectively.



Antioxidants in sugarcane germplasm

Antioxidants are valued plant products used in pharmaceutical industries. Sugarcane plants contain varying levels of antioxidants in its tissues and its commercial extraction is a possibility. Eight red fleshed sugarcane clones (*Saccharum robustum*) viz., 28 NG219, NG 77- 75, NG 77- 76, NG 77- 78, NG 77- 84, NG 77- 88, NG 77-90 and NG 77-132 were evaluated for total antioxidant, ascorbic acid and phenol content in juice. The clone NG 77-88 recorded the lowest content of 500 ppm and the clone NG 77-84 had the highest concentration of 1400 ppm. Four clones viz., 28 NG 219, NG 77-76, NG 77-78 and NG 77-84 had higher total antioxidant in juice (>1370ppm). Ascorbic acid content ranged from



Red fleshed *Saccharum robustum* cane

207 ppm (NG 77-38) to 260 ppm (NG 77-132). The phenol content in juice varied from 1940 ppm (NG 77-132) to 880 ppm (NG 77-90). Clones, NG 77-76, NG 77-84 and NG 77-90 contained higher phenol content (>2700 ppm) in juice. Co 99004 contained lower ascorbic acid and phenol than Co 86032. Phenol content of red fleshed clones studied had more than twice the value of the varieties Co 86032 and Co 99004.

Chemical ripeners on sucrose synthesis and accumulation in sugarcane

Two chemical ripeners (ethrel or glyphosate) were sprayed at 200 or 400 ppm concentrations on two popularly cultivated sugarcane varieties (Co 86032 and Co 94012). At the initiation of maturity, the acid invertase activity was $13.37 \mu\text{mol g fr wt}^{-1} \text{h}^{-1}$ in Co 86032 and $29.47 \mu\text{mol g fr wt}^{-1} \text{h}^{-1}$ in Co 94012. Following ethrel application, acid invertase activity was unaltered, while glyphosate (200 ppm) enhanced the acid invertase by 2.64 units in Co 86032 and 10.07 units in Co 94012. Neutral invertase showed an increased activity only in Co 94012. As maturity advanced, ethrel (200 ppm) treatment showed an improvement in acid invertase in both Co 86032 and Co 94012.

Juice quality:

The sucrose % juice at the initiation of maturity was 14.75% in Co 86032 and 15.15% in Co 94012 and 2 months after 200 ppm ethrel application, 1.59% and 1.26% improvement in sucrose % juice was noticed in Co 86032 and Co 94012, respectively. Glyphosate (200 ppm) showed 1.18% and 1.03% improvement in Co 86032 and Co 94012, respectively. Application of 200 ppm glyphosate enhanced the yield by 18.96% in Co 86032 and 17.18% in Co 94012. But 400 ppm glyphosate caused a yield decline of 30.21% in Co 86032, whereas variety Co 94012 was not affected.

Agronomic requirements of varieties under sub-tropical conditions (Karnal)

Various experiments conducted at the Karnal Regional centre on the agronomic requirements of sugarcane varieties yielded the following results:

Mid late varieties: Cane yield was 10.74% higher at 70 cm than 90 cm spacing. Sucrose per cent was higher at wider row spacing of 90 cm (18.56 %) than closer row spacing

(18.12%), however, sugar yield was 7.79% more at 70 cm due to higher cane yield/ha. Closer row spacing of 70 cm was found better for Co 0124 and Co 0123. Varieties Co 0241 and Co 0121 also should be planted at 70 cm spacing.

Early varieties: The cane yield of the early varieties was observed to be remarkably affected by row spacing. Sowing at 70 cm row spacing recorded significantly higher cane yield (20.06 %) than 90 cm row spacing (83.99 t/ha). Planting at 70 cm row spacing enhanced the ratoon yield in all the chosen early varieties as compared with 90 cm, but the differences in yield between 70 and 90 cm row spacing was minimum (5.12 t/ha) in Co 0238. It was also found that row spacing did not affect the pol % in juice.

Improving productivity of winter initiated ratoon

Application of fresh sulphitation press mud @ 20 t/ha at ratooning recorded the highest sprouting percentage, better growth attributes and gave significantly higher cane yield of 13.9% than control. Application of potash @ 60 kg/ha before one month of ratooning gave 6.5% higher cane yield than control plot. Raising onion as intercrop gave 3.24 % more cane yield than control plot. Sucrose % juice was maximum where combined application of potash @ 60 kg/ha + Zn50, @ 25 kg/ha was done at 30 days before ratooning with irrigation. Covering of harvested stubbles with fresh sulphitation press mud @ 20 t/ha increased the soil temperature of upper layer around 2°C than control plot.

Drought management in sugarcane

Application of FYM @ 10 t/ha, trash mulching (8-10 cm thick), foliar application of potash at 90, 105 and 120 days after ratooning and additional dose of potash @ 60 kg/ha given at 180 days had given higher ratoon cane yields of 9.6 % than control plot (71.6 t/ha). CCS % was maximum (13.30%) where additional K_2O @ 60 kg/ha was given at last irrigation (end of June) along with FYM, foliar spray of potash at 90, 105 and 120 days, trash mulching etc. against 12.84% recorded in control plot.

Among planting methods, pit planting gave the highest cane yield and it was significantly higher (12.6%) than cane planted at 90 cm row spacing. CCS% varied from 12.75 to 13.03%, maximum and minimum being at 90 and 60 cm spacing respectively. Sugar yield was also better in pit planting (10.32 t/ha) and was higher by 6.06, 10.25 and 11.80% than trench, 60 cm and 90 cm respectively.



Crop Protection

Pathology

Artificial reproduction of wilt

Detailed studies on artificial reproduction of wilt in sugarcane were conducted at Karnal and Gujarat under natural conditions and at Coimbatore a combination of drought and water logging was imposed along with pathogen inoculation. The fungal cultures isolated from the respective locations were inoculated by the standard plug method used for red rot inoculation. Disease evaluation five months later revealed a very clear reproduction of wilt in a set of varieties at all the locations, whereas some of the varieties remain symptom-free indicating their resistance/tolerance. At Karnal, typical wilt development was noticed only in Co 419, Co 975 and Co 7717 whereas, the varieties like Co



89003, CoS 8436 and CoJ 64 did not show wilt infection. At Coimbatore, of the varieties Co 419, Co 6304, Co 86032, Co 86249, CoC671, CoC 90063 and CoC 92061 inoculated on Co 419, Co 6304 and CoC 92061 were found to show typical wilt symptoms and other varieties remained free from the disease symptoms (See photo).

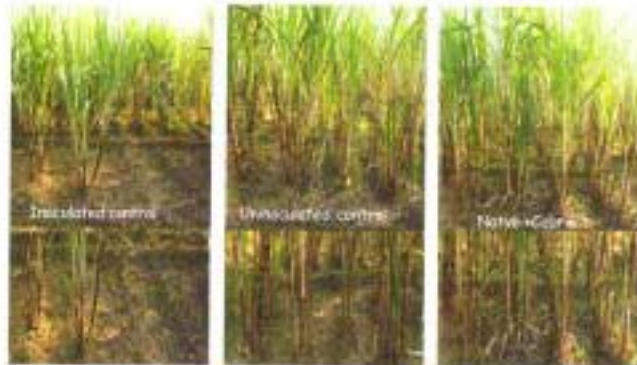
Screening for red rot resistance

In CCT method, 2386 genotypes/varieties were screened for red rot resistance among them 749 clones were identified as resistant/moderately resistant to the disease. Screening for red rot resistance at Karnal revealed that the sugarcane varieties Co 0327, Co 0331, Co 0424, Co 05009, Co 05010 and Co 05011 are resistant to the disease.

Fungicidal management of red rot

Studies on the management of red rot with fungicides revealed that fungicide treatment protected the planted setts from soil borne inoculum and improved germination. The fungicide treated plots also recorded better crop stand with maximum plant survival at the end of the season.

Among all the treatments, Nativo 75WDG, either alone or in combination with Cabrio 60 WDG were found to be most effective as compared to other fungicides. Overall, it was found that fungicide treatment significantly improved yield attributes like cane growth, number of millable canes and single cane weight in the field.



Efficacy of new systemic fungicides for the management of red rot

New differentials to identify variation in red rot

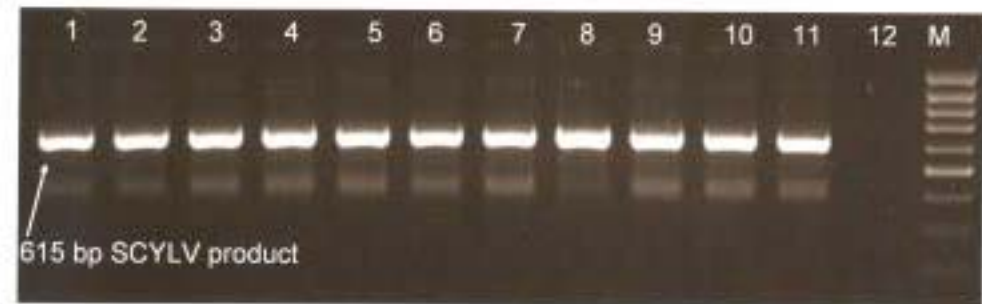
Twenty pathotypes of *C. falcatum* collected from Tamil Nadu, Andhra Pradesh, Orissa and Gujarat were tested on 31 sugarcane varieties varying in red rot resistance to identify new differentials and most virulent pathotypes. The varieties Co 7805, Co 8021, Co 86002, Co 86032, Co 89003, Co 94008, Co 97009, Co 99004, Co 99006, Co 0238, CoJ 88, CoLk 8102, CoPant 94212, and CoV 92102 showed differential behaviour to the pathotypes. This study also revealed the virulence of the new pathotypes Cf98010, Cf94012, Cf6907 and Cf94003.



Differential behaviour of nine sugarcane varieties Co 7805 Co 8021 Co 8371 Co 86002 Co 86032 Co 94003 Co 99004 CoV 92102 CoPant 84212 to *C. falcatum* pathotype Cf94012

Virus indexing

Virus indexing of field samples drawn from many apparently healthy plots in the farmers' fields and tissue culture seedlings showed that most of the samples were positive to the virus. These results indicate the widespread occurrence of SCYLV in sugarcane with varying virus titre.

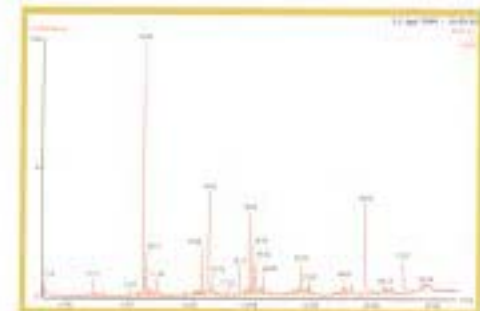


1-11; tissue Cultural Seedlings; 12. -ve Control; M: Marker Indexing of sugarcane tissue culture seedlings for sugarcane yellow leaf virus causing YLD by RT-PCR

Entomology & Nematology

Studies on Head space volatiles in sugarcane plants under simulated conditions of stress

With a view to discern the chemicals that may play a possible role in influencing the decision of host larval recognition by the parasitoids on sugarcane plants, the composition of Head space volatiles was studied under three types of simulated conditions of stress, viz., mechanical injury, mechanical injury reinforced with shoot and internode borer larval regurgitants to simulate pest attack and salicylic acid spray. GC-MS spectra (See picture) of the Head space volatiles analysed indicated vast differences in their chemical composition under all the three situations and were found to comprise a large number of compounds—the major ones being phenols, octadecane, indole decanoic acid, cyclopentanol, 1,2, benzene dicarboxylic acid, and other long chain alcohols and aldehydes.



GC-MS Spectra of compounds detected in the volatiles

Comparative virulence of entomopathogenic fungi

Virulence of three entomopathogenic fungi was assessed against internode borer by two methods, viz. topical application and thin film methods, alone and in combination with each other as well. Mortality due to the fungi ranged from 80.00 to 93.33% in topical application method while it was 73.33 to 82.23% in the latter method. When larvae were exposed to treated surface in the thin film method in combinations to fungi, *B. bassiana*, *M. anisopliae* and *B. brongniartii* showed dominance more or less in the same order. Although all the three fungi individually produced significantly higher mortality than the predominant saprophytic fungi *Aspergillus*, they showed reduced mortality in combination with the latter, apparently due to interactive effect.

Encarsia flavoscutellum as a regulator of woolly aphid damage

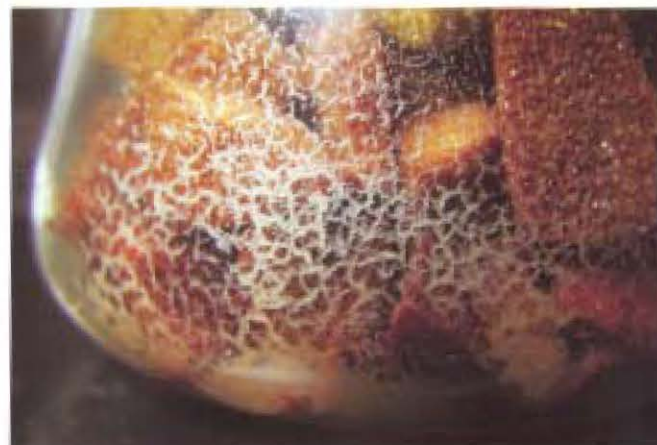
The role of *Encarsia flavoscutellum* in regulating woolly aphid populations and preventing economic damage was assessed by comparing growth parameters of cane in two infested patches with that in an uninfested patch. Under the influence of the parasitoid, the aphid disappeared within about two months from the two patches with no further re-colonization. Yield parameters recorded at harvest from about 10-20 canes in each patch showed that mean height and weight of individual canes did not differ between either of the infested patches and uninfested control patch, though the mean girth or diameter of individual canes in one patch was significantly lower than that in control patch. The parasitoid thus regulated woolly aphid numbers, reduced its spatial and temporal spread, and prevented economic damage.



Adult *Encarsia flavoscutellum*

In vitro mass production of entomopathogenic nematodes

Maximum mass production of *Steinernema glaseri* was achieved in egg yolk soya flour (22,40,000 IJs/250ml flask) followed by Wouts media. These were followed by Bengal gram, wheat flour and dog biscuit media; lowest production (85,000 IJs/250ml flask) was observed in corn flour media. In the case of *Heterorhabditis indica* too, maximum production was observed in egg yolk soya flour (3,16,000 IJs/flask) followed by Wouts media. These were followed by Bengal gram, dog biscuit and wheat flour media; lowest production (1,02,000 IJs/250ml flask) was observed in corn flour media.



In vitro mass production of entomophilic nematodes

“.....the crop needs to be accepted as a companion continuously and lovingly watched like a sick - bed fellow or a new born child for its every little reaction to the environment.....”

-Sir T.S. Venkataraman

Outreach



Sugarcane Research & Development Workers' meeting – Tamil Nadu

The 40th meeting of Sugarcane Research and Development Workers of Tamil Nadu hosted by Subramariya Siva Co-op Sugar Mills Ltd., Gopalapuram was held at Hotel Cennys Gateway, Salem during September 25-26, 2008 to discuss the following topics:

- i. Review of action taken on the recommendations of the 39th meeting
- ii. Post Harvest Deterioration in sugarcane
- iii. New disease of sugarcane – Yellow Leaf Disease (YLD) & its management
- iv. Performance of new sugarcane varieties
- v. Co-ordinated agronomic experiments
- vi. All India Co-ordinated Research Project on Sugarcane
- vii. Sugarcane seed nursery programme.

The meeting was inaugurated by Shri. Veerapandi S.Arumugam, Hon'ble Minister for Agriculture, Govt. of Tamil Nadu while Shri. Atulya Misra, IAS., Commissioner of Sugar and Registrar of Co-op Sugar Mills, Govt of Tamil Nadu delivered the Presidential Address.

Dr.N.Vijayan Nair, Director of Sugarcane Breeding Institute delivered the Theme address in this meeting in which about 350 delegates comprising scientists from Sugarcane Breeding Institute, Coimbatore & Tamil Nadu Agricultural University, Development Department personnel from various sugar factories, officers from the Department of Agriculture, Directorate of Sugar and other cane Development organizations in Tamil Nadu participated.



Shri. Veerapandi S Arumugam, Hon'ble Minister for Agriculture, Govt. of Tamil Nadu releasing the "Compendium of Research Articles & Status Papers" at the meeting

Using Focus Groups: a qualitative inquiry into the information needs of cane development personnel and cane growers

Focus group methodology, a way of systematically acquiring qualitative data, was found to be a powerful tool in identifying the information needs of the target audience in the course of developing a website on sugarcane production technologies.

Recognizing that only by bringing the user into the development process could the utility of the website be maximized, a series of Focus groups were conducted by SBI with the target audience of the proposed website viz., the cane development personnel and the cane growers.

Four focus groups conducted in Pugalur (E.I.D Parry [I]Ltd area) and Appakudal (Sakthi Sugars Ltd., area) in Tamil Nadu during October-December 2008, identified the users' information needs by exploring their expectations from the website, attitude towards Internet, computer usage, problems experienced in obtaining digital information and on their content priorities in sugarcane production.

These sessions that were recorded and transcribed revealed that the audience needs information on location-specific sugarcane varieties, mechanization options, nutrient management including online recommendations for fertilizers and timely information on new pests & diseases. They also preferred a portal that would act as a 'one-stop information provider' providing details on input availability, latest news and events in sugarcane, price information, directory of sugarcane factories and research institutions, weather and market links. While the cane growers preferred an easy access to sugarcane researchers and a provision to download publications in the local language, the cane development personnel insisted on having dynamic content. Both the cane growers and cane development personnel wanted the website to be interactive, with sufficient multimedia content.



Focus group at Pugalur

The Focus groups evoked a good response from the participants and were found to draw upon the attitudes, feelings, beliefs, experiences and reactions of the prospective website users in an effective way, which would not be feasible using other data collection methods such as observation, one-to-one interviewing, or questionnaire surveys.

Kisan mela at Karnal

A Kisan Mela was organized at Karnal on 25.11.2008.

An exhibition displaying the research achievements at different research organizations located in Karnal and chemicals, fertilizers and farm machinery by private

firms was arranged during the Kisan Mela. Dr.N.V.Nair, Director who inaugurated the mela, felicitated Shri. Gurmail Singh a progressive farmer of Talakaur village, Yamuna nagar for achieving higher sugarcane productivity by adopting Intercropping. About 400 farmers and staff of 20 sugar mills from Haryana, Punjab, UP and Uttrakhand participated in the Kisan Mela and were benefited.



Sri. Gurmail Singh, a progressive farmer (left) being felicitated by Dr.N.V.Nair, Director of SBI

Frontline demonstration

Six Frontline Demonstrations (Variety Co 94012 - 2 nos., Biofertilizer application, Pit method of planting with drip fertigation, Paired row planting with drip fertigation - 2 nos.) were conducted in the farmers fields during the period. The crop was harvested during Oct-Dec. 2008. The cane yield (t/ha) obtained are:

- Varietal demonstration in 90 cm spacing- Co 86032: 120.00, Co 94012: 123.75
- Bio-fertilizer application, variety Co 86032- Treatment: 102.5, Control: 100.00
- Pit method of planting with drip fertigation - Co 86032, Pit: 137.50, 90 cm: 130.00
- Paired row planting with drip fertigation - Treatment: 162.50, Control: 130.00
- Paired row planting with drip fertigation - Treatment: 117.50, Control: 107.50
- Varietal demonstration in 90 cm spacing - Co 86032: 125.00, Co 94012: 130.00



FLD Plot at Alanthurai

Foundation Day

The Foundation Day of SBI was celebrated on October 25, 2008. Dr.P.Venkat Rangan, Vice Chancellor, Amritha Vishwa Vidyapeetham, Coimbatore was the Chief Guest. During the occasion, the Scientists Club of SBI honoured Dr.H.David and Dr. K.C.Alexander, Retired Scientists of SBI. The first Sir T.S.Venkataraman award for Best scientist in sugarcane agriculture was presented to Dr.R.Viswanathan, Senior Scientist (Pathology), SBI and Sir T.S.Venkataraman award for Best thesis in sugarcane was presented to Dr.Praneetha.



Dr. R.Viswanathan (second from right) receiving the first Sir T.S.Venkataraman award

National Science Day

National Science Day was observed as an 'open day', on February 28, 2009 by allowing students of schools and colleges to visit the our institute for inculcating scientific awareness in their minds for nation building. Nearly 500 students visited the institute. During the occasion, a special lecture on the theme, "Expanding horizons of science" was delivered by Dr. Mylswamy Annadurai, Project Director, Chandrayaan – I&II, ISRO, Bangalore.



Dr.M.Annadurai, Project Director, Chandrayaan I & II delivering the Science Day lecture

Farmer- Cane development personnel - Scientist interactive session

A farmer- cane development personnel – Scientist interactive session was organized in Pugalur in association with EID Parry (I) Ltd on 4.12.2008. During this session, the scientists answered an array of questions related to sugarcane crop production and protection technologies. The questions ranged from improved varieties with high yield, adaptability, pest and disease resistance, etc. to soil and plant health management. Office bearers of various farmers' associations belonging to Tiruchy, Karur and Erode districts of Tamil Nadu, several progressive farmers and cane development personnel from Pugalur and Pettavaithalai factories of EID Parry (I) Ltd participated and benefited from the interaction.



Interactive session with farmers and factory personnel

National Level Training

Three National level training programmes sponsored by the Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, were conducted on Sugarcane cultivation in biotic and abiotic stress conditions, Use of appropriate sugarcane varieties for increasing sugar recovery and Drought management in sugarcane. Training Manuals on the respective topics were printed and distributed to the participants.

Campaign on Water management

An awareness campaign on "Water management" was conducted as part of the Farmers' Participatory Action Research Programme (FPARP) in association with the Dharmapuri District Co-op Sugar Mills Ltd during 14-15 November 2008 in Dharmapuri, with the following three components.

- i) Method demonstrations in the farmers' fields
- ii) An intensive Training session on various water conservation techniques &
- iii) Participatory planning of activities for implementing FPARP

A large number of cane growers participated and benefited in this two-day programme.



Method demonstration at Kodiur village



A section of the participants

Participation in exhibitions

Participated in Regional Agricultural Fair for Southern Region organised at Acharya N.G Ranga Agricultural University, Hyderabad during 20-23 December 2008 with the theme on 'Sustainable Agriculture'. We had put up a stall depicting the new sugarcane varieties, crop production and protection technologies. There were at least 5000 visitors each day in the Fair.



SBI Exhibition stall at Regional Agricultural Fair at Hyderabad

World water day celebrations

The World Water day was celebrated at Akkarai negamum village in Erode district of Tamil Nadu on 25.3.2009. The following activities marked the celebrations.

- ❖ Demonstrations on the use of soil moisture tensiometers

- ❖ Exhibition on 'Trash composting'
- ❖ Release of FPARP technical bulletin, "How to use tensiometers?" (Tamil)
- ❖ Method demonstrations on trash mulching, trash composting, composting using earthworms and on applying liquid bio-fertilizers.

FPARP participants, officials from the Central Water Commission, Govt. of India and cane growers registered with Bannari Amman Sugars Ltd participated in the programme



Release of Technical bulletin

A farmer shares his experiences





Miscellaneous

Academic activities

PhDs awarded

Four candidates from the Institute were awarded PhD degree from Bharathiar University, Coimbatore during the year

- ❖ Smt. M.Kanchana - Integration and expression of genes coding for pathogenesis related proteins in a sugarcane cultivar with particular reference to red rot resistance (Supervisor : Dr. N.Subramonian) Smt.Kanchana's study was aimed at developing transgenics in the variety CoC 671 through particle bombardment with genes coding for chitinase, 1,3 β glucanase and the defensin Dm- Amp1, either individually or in combination with a view to study their efficacy for imparting red rot resistance. The results indicate the possibility of developing red rot resistant sugarcane cultivars through transgenic technology with increased expression of the transgene in the nodal region.
- ❖ Smt. R. Lalitha - Studies on differential functioning of haploid and diploid gametes in interspecific and intergeneric hybrids of *Saccharum* (Supervisor : Dr. M.N.Premachandran) Smt.Lalitha studied the chromosome transmission in different interspecific and intergeneric hybrids involving *Saccharum officinarum*, *S. spontaneum*, *Erianthus arundinaceus*, *Erianthus bengalense* and commercial sugarcane clones. The meiotic behaviour and fertility of the intergeneric hybrids between *S. spontaneum* and *E. arundinaceus* and their hybrids with sugarcane and backcross hybrids with parental species indicated that desirable genes from these wild species can be introgressed to cultivated sugarcane.

- ❖ Shri. S. Vidyasekar – Sucrose metabolism and spatial regulation of sucrose accumulation in sugarcane (Supervisor : Dr. S. Venkataramana) The results of Shri. VidyaSekar's work on photosynthetic events, enzyme systems, protein profiles, molecular characterization involving RAPD and RT-PCR indicated that it would be possible to regulate the sucrose synthesizing process, which would ultimately help in achieving high yielding, sugar-rich sugarcane varieties.
- ❖ Smt., R. Radhamani – Iron nutrition of sugarcane (Supervisor : Dr. P.Rakkiyappan) Smt.Radhamani's study on the effect of different ameliorative treatments to mitigate iron chlorosis and varietal response of sugarcane grown under iron deficient conditions revealed that application of soil ameliorants increases the soil availability of Fe and other nutrients. Varieties Co 8021, Co 86032, Co 86249, Co 94005, Co 94008 and Co 94012 were found relatively tolerant to iron deficiency.

Twenty-five participants from different states of the country viz. Punjab, Uttarakhand, Rajasthan, Maharashtra, Gujarat, Orissa, UP, Kerala and Tamilnadu and from different backgrounds (Plant breeding & Genetics, Plant pathology, Plant Physiology, Botany and Biotechnology) attended the short course. Dr. P. Vidhyasekaran, former Director , Centre for Plant Protection studies, Tamil Nadu Agricultural University, Coimbatore was the chief guest for the inaugural session, while Dr. Anandaraj, Project Co-ordinator, Spices was the chief guest for the valedictory session.

User-awareness Programme

A user-awareness programme on CeRA (Consortium for e-Resources in Agriculture) was conducted on 7 October 2008 for the benefit of the scientists. Scientists from Sugarcane Breeding Institute and the regional stations of Central Institute for Cotton Research and Central Institute of Agricultural Engineering participated and benefited from the programme.

Post Graduate Training

- ❖ Sixty nine post graduate students were imparted one month training on Biotechnology, Bio-chemistry, Nematology and Microbiology under different divisions of the Institute
- ❖ Thirty-two postgraduate students undertook their project work at the Institute on a wide range of topics on Biotechnology.



Dr.N.V.Nair, Director, SBI addresses during the inaugural function

ICAR-Sponsored Short Course

Institute organized a short course on "Application of molecular tools in identifying disease resistance genes/mechanisms in crop plants at SBI, Coimbatore during Dec. 10-19, 2008.



CeRA User-awareness programme

Visits abroad

- ❖ Dr. N.Vijayan Nair, Director visited Sugar crops Research Institute, Giza, Egypt as a consultant for sugarcane improvement programme during Aug. 12-23, 2008.
- ❖ Dr.R.Viswanathan, Principal Scientist was deputed to Wageningen University, Laboratory of Phytopathology, The Netherlands for a period of three months w.e.f. 15-2-2009 to 15-5-2009 to undergo training on Gene silencing to study defense gene involved in disease resistance under DBT's Overseas Associateship Programme for 2007-08

Awards/Recognition

- ❖ Dr. N. Vijayan Nair, Director has been nominated by the President, ICAR as a member in the reconstituted committee on Agricultural Research Service for a period of two years w.e.f. Sept. 1, 2008
- ❖ Dr.R.Viswanathan, Senior Scientist (Pathology) received the first Sir T.S. Venkatraman award for Best scientist in sugarcane agriculture instituted by M/s Eco Foundation, USA at SBI on October 25, 2008.
- ❖ Dr. M. Praneetha, Ph.D scholar of the institute received the first Sir T.S. Venkatraman award for Best Ph.D thesis in sugarcane instituted by M/s Eco Foundation, USA at SBI on October 25, 2008.
- ❖ Institute received a certificate from Town Official Language Implementation Committee, MoHA/Gol for the commendable performance in the implementation of official language during 2007-08 in Government Offices category.
- ❖ Dr. N.Vijayan Nair, Director has been nominated as a member in the Development Council for sugar industry (DSCI), MoCAF&PD/Gol for a period of two years from Dec. 4, 2008

PUBLICATIONS FOR SALE

BOOKS

S.No.	Details of the book	Year	*Price in Rs.
1.	Handbook on Sugarcane Diseases and their Management <i>By R.Viswanathan and P. Padmanaban Paperback, 78p.</i>	2008	120.00
2.	Sugarcane Production Manual <i>Eds. K.C.Alexander and S.Arulraj, Paperback, 129p.</i>	1995	40.00
3.	Sugarcane Varietal Improvement : Proceedings of the International Symposium on Sugarcane Varietal Improvement - Present Status and Future thrusts at SBI during Sept.3-7,1987 <i>Eds. K.Mohan Naidu, T.V.Sreenivasan and M.N.Premchandran, HB, 364p.</i>	1989	310.00
4.	Sugarcane Varieties in India (1979- 86) : Morphological descriptions and agricultural characteristics <i>By P.Sankaranarayanan and B.V.Natarajan,Hard & Spiral bound, 239p.</i>	1987	145.00
5.	Sugarcane Entomology in India <i>Eds. H.David, S.Easwaramoorthy and R.Jayanthi, Hardbound, 564p.</i>	1986	138.00
6.	Catalogue on Sugarcane Genetic Resources - I (<i>Saccharum spontaneum</i>) / <i>By P. Kandasami et al.</i>	1983	75.00

CDs

S. No.	Topics	Language	*Price in Rs.
1	Interactive multimedia on sugarcane Production	English	500.00
2	Expert system package on sugarcane pest management	English	500.00
3	Achievements of TAR / IVLP at SBI	English, Tamil, Telugu, Kannada & Hindi	100.00
4	Sugarcane varieties	- do -	100.00
5	Ratoon Management	- do -	100.00
6	Integrated nutrient management	- do -	100.00
7	Wider row spacing	- do -	100.00
8	Integrated disease management	- do -	100.00
9	Integrated pest management	- do -	100.00
10	About Sugarcane Breeding Institute	- do -	100.00
11	Biofertilizers	- do -	100.00
12	Organic recycling	- do -	100.00
13	Cane of Prosperity (SBI - A profile) / 2008	- do -	200.00

Copies can be obtained:

1. By Cash: from Library (Books) and Extension Section (CDs)
2. By Post : from the Director, SBI by sending a demand draft for the cost of the book (s) /CD(s) drawn in favour of " Director, Sugarcane Breeding Institute" on any nationalized bank in Coimbatore

Contact : Ph: 0422 - 2472621 Extn: 209 Email : sbilibrary@gmail.com

* Price is inclusive of packing and forwarding charges



THIS TABLET PRESENTED TO THE
SUGARCANE BREEDING INSTITUTE, COIMBATORE,
BY THE INDIAN SUGAR MILLS ASSOCIATION
COMMEMORATES THE EVOLUTION OF CO. 205
BEING THE FIRST OF THE CO CANE SERIES
TO ACHIEVE COMMERCIAL IMPORTANCE
IT ALSO COMMEMORATES THE WORK OF THE HEADS OF
THE INSTITUTE
DR. C. A. BARBER (1912-1918)
DR. T. S. VENKATARAMAN (1918-1942)
SRI N. L. DUTT (1942-1956)
UNVEILED BY
SRI M. BHAKTAVATSALAM MINISTER FOR AGRICULTURE MADRAS
ON 14-1-1956



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Sugarcane Breeding Institute

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Coimbatore - 641 007, India

