SBI News

ICAR - Sugarcane Breeding Institute, Coimbatore 641 007
Tamil Nadu, India

ISSN 0973 - 8170

Vol. 35 No. 3
July 2015, Quarterly

SUGARCANE CULTIVATION THROUGH TRUE SEED - A HISTORIC STEP TOWARDS CHANGING THE MODE OF TRANSPORTATION OF SUGARCANE SEED FROM TRUCK TO PACKET

The commercial cultivation of sugarcane is done using cane cuttings as the planting material and the cane requirement for planting varies from one 6-8 tonnes per hectare. Sugarcane is being cultivated in about 5 million hectares in India and the planting material required annually is to the tune of 14.42 million tonnes even after considering the ratooning of the crop in nearly 55% of the area. The recent introduction of transplanting of bud-chip / single bud raised settlings has come in a big way in reducing the seed requirement to 1/6th, on an average basis. It ensures good establishment in the field after a two months nursery phase. However, its adoption is limited and there is a need to popularize this technique throughout the country.

Sugarcane true seed is used in breeding for selection of superior clones and is not used for commercial cultivation because heterozygosity in the parental clones leads to high heterogeneity among progenies. Transplanting of true seed raised seedlings can replace the settling planting by exploiting the advantages of flowering and seed set in sugarcane clones if the uniformity in progeny can be attained. The true seed planting can reduce the weight of planting material from a truck load to a small pocket capacity as only 30 gram of true seed is sufficient for a hectare. Varietal replacement required in large areas due to disease epidemics or natural calamities can be much easier through true seed compared to seed cane. There are many other advantages of true seed planting, especially the avoidance of systemic and sett transmitted diseases that affect the yield and quality by degeneration of sugarcane varieties. New superior hybrid varieties can be expanded to

CONTENTS

larger areas in a short time span also. Vision 2050 of ICAR-Sugarcane Breeding Institute has now launched this ambitious mission of developing true seed that will be sufficiently uniform for commercial cultivation. This historic decision was taken after a brain storming discussion on 5 June 2015 during the Institute Research Committee Meeting.

eeding for selection of superior clones and is not used for commercial cultivation because heterozygosity in the parental clones leads to high heterogeneity among progenies. Transplanting of true seed raised seedlings can replace the settling planting by exploiting the advantages of flowering and seed set in sugarcane clones if the uniformity in progeny can be attained. The true seed planting can reduce the weight of planting material from a truck load to a small pocket capacity as only 30 gram of true seed is sufficient for a hectare. Varietal replacement required in large areas due to disease epidemics or natural calamities can be much easier through true seed compared to seed cane. There are many other advantages of true seed planting, especially the avoidance of systemic and sett transmitted diseases that affect the yield and quality by degeneration of sugarcane varieties. New superior hybrid varieties can be expanded to larger areas in a short time span also. Vision 2050 of ICAR- Sugarcane Breeding Institute has now launched this ambitious mission of developing true seed that will be sufficiently uniform for commercial cultivation. This historic decision was taken after a brain storming discussion on 5 June 2015 during the Institute Research Committee Meeting.

However, there are several constraints that put forth some researchable issues. First is the availability of homozygous parental lines with good specific combining ability to develop heterotic hybrid with high yield, quality and resistance to major stresses. So, the choice of parental lines becomes crucial. Another approach is repeated selfing of sugarcane clones for few generations to develop inbreds and identifying homozygous lines guided by molecular marker profiling and progeny testing. On-going efforts in this line have given encouraging results and still more to be investigated for the right parental selection. Development of haploids through anther culture is a near perfect method for deriving parental polyhaploids with homozygosity. Intensive research is needed in standardizing the technique for haploid production in sugarcane at the Institute. Other potential approaches tried in related crops like induced uniparental chromosome elimination as done in maize and wheat and centromere-mediated genome elimination by manipulating a single centromere protein CENH3, need to be carried out in a focused manner.

Apomixis is a widespread phenomenon in grasses and the benefit of introducing apomixis into crops would be to allow selecting an individual plant or clone which will be true breeding and can be propagated through its seeds. Efforts directed at determining the genetic basis of apomixis in several species have generally shown it to be under simple genetic control and success was reported in several cases including *Panicum, Paspalum, Tripsacum,* etc. Hence, introduction of apomixis in sugarcane is one of the vital starting points of research in this direction. Different scientific approaches to the study of apomixis would be the generation of hybrids between sugarcane and apomictic wild varieties or species of related grasses, identifying and mapping the genes regulating apomixis with the view of transferring them to sugarcane through genetic engineering and mutagenesis. Initial findings at the Institute on apomixes, especially pseudo vivipary in *Neyraudia reynaudiana* and culturing of floral primordia of *Saccharum edule* for raising plants are encouraging. The candidate genes responsible for the phenomenon would simplify the development of apomictic lines through genetic engineering.

Once the true-breeding true seed of sugarcane could be produced, the fluff has to be processed for production of defuzzed seeds. Seed Technology laboratory of the Institute has already come out with a prototype defuzzer (defuzzing machine). Through defuzzing, seed treatment is possible for avoiding pathogen invasion and will enable seed storage for a longer period. The processed seed can be packed, sent and sown with ease and transplanted as practiced with bud-chip / single bud settlings.

True seed production initiative envisages a multidisciplinary research approach with contributions from breeders, biotechnologists, crop stresses management experts and seed technologists. This technology is expected to bring a path breaking shift in sugarcane planting by 2050 AD, though Vision 2050 document of the institute has projected a modest target of covering only 20% of area under true seed cultivation.

Despite the anticipated constraints that have to be systematically addressed with the tools of modern agriculture, the technology, no doubt, would ensure faster multiplication of a variety, generating healthy planting material free of sett borne diseases and yielding more vigorous crop with less virus load to make sugarcane cultivation more profitable and sustainable.

Sulphur nutrition of sugarcane

Sugarcane is a high biomass yielding C4 crop which requires substantial inputs to fulfill its high nutrient requirements. Growing high yielding sugarcane varieties with high nutrient requirement coupled with unbalanced fertilization, use of high analysis sulphur (S) free fertilizers and inadequate or absence of organic recycling results in fast depletion of soil S reserves. The sulphur absorption by sugarcane is comparable to that of phosphorous for the healthy growth and optimum cane yield. In India, about 30% of the cultivated land area is reported to be deficient in sulphur.

A survey of the sulphur status of major sugarcane growing soils of parts of Tamil Nadu and Karnataka results revealed

that about 17% of the soils were low in available S (<10 ppm) while 35% were medium (10 - 20 ppm) and 48% were high (>20 ppm). A linear trend was noticed in plant top visible dewlap (TVD) S with soil available S up to 45 ppm, beyond the soil critical S content of 10 ppm. Principal Component analysis revealed that 0.15% $CaCl_2$, ammonium acetate-acetic acid and mono calcium phosphate extracted S contributed more towards plant TVD leaf S.

A field experiment was laid out in RBD with five treatments *viz.,* i) control (no sulphur), ii) elemental sulphur, iii) elemental sulphur with sulphur solubilizer (*Thiobacillus thiooxidans*), iv) single super phosphate and v) gypsum in medium alkaline soil at ICAR-Sugarcane Breeding Institute to study the response of sugarcane (cv Co 86032) to various sources of sulphur. Sulphur was applied @ 47.5 kg/ha in treatments 2 to 5. The results revealed that application of S @ 47.5 kg/ha significantly increased the cane yield (table 1, Fig. 1).

The mean yield in sulphur treated plots was 80.2 t/ha while in control it was 61.8 t/ha, resulting in a yield improvement of 29.8 per cent. The highest yield of 82.7 t/ha was observed in elemental S + *Thiobacillus thiooxidans* applied plot, which was on par with elemental S alone (80.4 t/ha), SSP (78.5 t/ha) and gypsum (79.3 t/ha). The highest single cane weight was observed in gypsum treated plot (0.95 kg) which was on par with all other sulphur treated plots but significantly higher than control (0.71 kg). The NMC and juice quality parameters at harvest were not significantly influenced by the treatments.

(A.Bhaskaranand C. Palaniswami)
Division of Crop Production

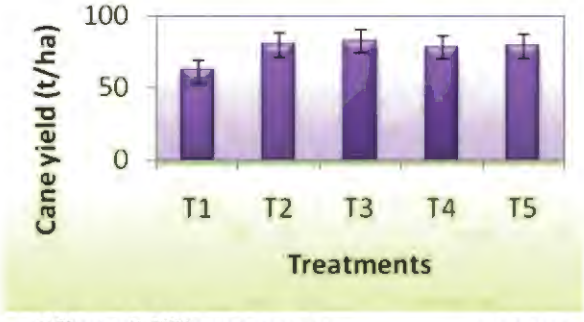

Fig. 1. Effect of different sources of sulphur on cane yield of sugarcane

A new technology for rapid treatment of sugarcane planting material

Sugarcane diseases pose major challenge for crop production in all the sugarcane growing countries. As sugarcane is propagated only by vegetative means, it favours transmission of major diseases through planting materials. Besides, major fungal pathogens causing diseases such as red rot and wilt survive in the soil (debris) and infectseed canes immediately after planting. Our earlier studies with various fungicides indicated that overnight soaking is effective for the management of sett and soil borne fungal pathogens. However,overnight soaking is impractical on a large scale and hence application through other methods like spray/ soil drench and in some cases dipping the setts for short time were recommended. Considering the limitations in each method, an improved method of device for sett treatment working under the principle of vacuum infiltration was developed in plant pathology lab of SBI and the technology was patented as 'Rapid treatment for planting materials of sugarcane and other vegetatively propagated crops'.

Before patenting the technology, a lab prototype was developed (Fig. 2) and evaluated for sett treatment with fungicides and microbes under various situations mainly for disease management and growth promotion. Here, effective fungicides, *Pseudomonas fluorescens* and their combinations were evaluated for two different methods of

Fig. 2. Lab prototype - developed for validation by ICAR-SBI

Table 1. Single cane weight, NMC and juice quality parameters of sugarcane variety Co 86032 as influenced by sulphur sources

Treatments	Single cane weight (kg)	NMC	Brix	Purity (%)	Sucrose (%)	CCS(%)
T1. Control	0.71	87346	21.4	83.76	17.94	12.08
T2. Elemental S	0.85	95293	21.5	84.18	18.11	12.22
T3.Elemental S + Thiobacillus thiooxidans	0.86	96373	21.78	3.10	18.06	12.11
T4. Single super phosphate	0.88	89198	21.48	5.41	18.31	12.45
T5 .Gypsum	0.95	84182	21.48	4.78	18.17	12.31
Sed	0.05	7174	0.32	1.22	0.38	0.33
CD	0.12	NS	NS	NS	NS	NS

sett treatment *viz.,* conventional-overnight soaking and mechanized-vacuum infiltration. The treatment methodswere evaluated for selecting fungicidal dosage, vacuum level for mechanized treatment, duration of sett treatment, compatibility among the fungicides, application of inducers, biocontrol agents (*Pseudomonas fluorescens)*, beneficial microbes (*Azospirillum*, *Glucanoacetobacter* and Phosphobacteria), their efficacy and phytotoxic effect on sugarcane growth. During evaluation for various inputs, the results on tissue bioassay, indicated that the uptake and efficacy of fungicides/ microbes was found to be on par for both the methods of treatment in terms of disease control and growth promotionunder both the pot culture and field experiments. Besides, the mechanized treatment was found to have several advantages as listed below.

- Possibility to treat different kinds of sugarcane planting materials *viz.,* bud chips, single/ double/ three budded setts
- Possibility to deliver manyinputs *viz.,*agrochemicals and microbes (fungicides, insecticides, inducers, micro and macro nutrients, growth hormones, chemicals for abiotic stress tolerance, biocontrol agents, growth promoting bacteria / biofertilizers).
- Possibility to deliver all the compatible inputs at once
- By uniform treatment effective delivery of inputs is achieved
- Reduced quantity of chemical/ input which economizes chemical usage and less impact on environment
- The process is rapid and saves treatment time
- Less cumbersome in handling material and has practical applicability
- Amenable for large scale application under farmer's field conditions

Based onthe results obtained with lab prototype, new units of different size have been fabricated inthe DST- IDP programme on 'Development of mechanised system for effective sett/ bud treatment of sugarcane'under collaborationwith CIAE. The unitswere specifically tested for the management of fungal diseases with fungicides/ microbes and for raising healthy nursery although this can be adopted for other agrochemical supporting sugarcane cultivation.

Effect of mechanized sett treatment for disease management

The newly fabricated units have been validated under field conditions in the instituteand factory areas of Shri Ambika Sugars, Tuhili, Thanjavur Dt, Tamil Nadu (Fig. 3) for the delivery of fungicides, insecticides, microbes (biocontrol agents –P. *fluorescens,*) individually or in combination with a duration of 15 minutes for treatment. The results revealed that the mechanized treatment was found to be on par with overnight soaking and recorded better germination and

Fig. 3. Validation of mechanized sett treatment for disease management in sugar factory area

maintained a good crop stand. Also provided effective disease control during early stages of crop across the varieties for red rot, smut and wilt management under field conditions (Fig. 4 & 5).

Overnight soaking | Mechanized sett treatment | Inoculated control

Fig. 4. Comparative effect of conventional soaking and mechanized sett treatment for red rot management

Over night Mechanized Co 89003 | *Over night Mechanized CoH 70*

Over night Mechanized Co 99006

Fig. 5. Sett treatment of different clones for wilt management

Role of mechanized sett treatment device in healthy nursery programme

Seed material plays an important role in sugarcane production. By treating the planting materialwith different inputs through simple, rapidand cost effective method, we can produce good quality settlings with improved germination, growth promotion and resistance to biotic and abiotic stress.We optimized dosage of inputs *viz.*, urea, superlime and carbendazim for mechanized treatment of single bud setts for healthy settlings nursery programme forPonni Sugars (Erode) Ltd, Namakkal Dt, Tamil Nadu and compared with conventional soaking for 30 minutes. By mechanized treatment, the concentration of urea and superlime was reduced from 2.5 to 0.25% and the treated setts exhibitedbetter germination and growth (Fig. 6). Overall, by adopting new sett treatment method high quality settlings are produced and such settlings recorded good crop stand in field.

P. Malathi, R. Viswanathan, A. Ramesh Sundar and C. Naveen Prasanth

Crop Protection Division
Sugarcane Breeding Institute, Coimbatore

Ravindra Naik and Jacob Annamalai,
Central Institute of Agricultural Engineering
Regional Centre, Coimbatore

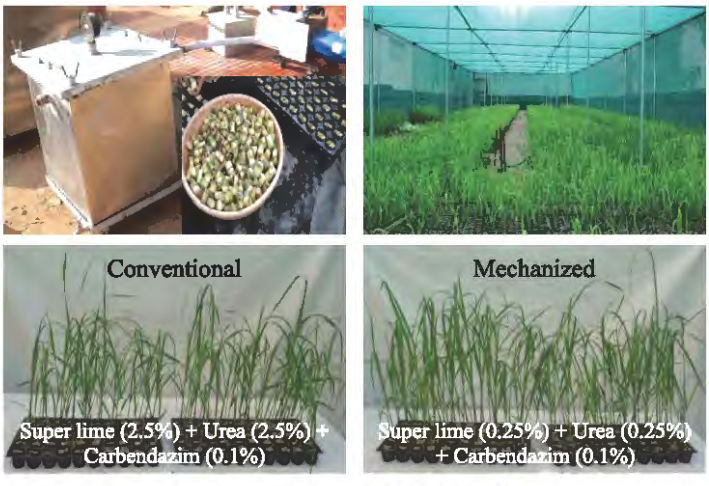

Fig. 6. Impact of mechanized treatment on delivery of different inputs for Healthy Nursery Programme

One day training programs

A one day training on 'Sugarcane technologies' was organized for 47 farmers from Kallakurichi Coop Sugar Mill Unit 1 on 17 April 2015 (Fig. 7).

Tribal Sub Plan

Tribal Sub Plan was implemented by this institute in a tribal village - Vellamari in Agali panchayat, Mannarkad taluk, Palakkad district, Kerala with emphasis on mechanization in agriculture. There are 196 households in this village owning 110 acres of cultivable land wherein crops like coconut, arecanut, banana, vegetables, wild jasmine, pulses etc. are cultivated. During the focus group discussions held in this village, it was understood that the usage of

Fig. 7. Farmers visiting institute museum

machineries was minimum but for spade, hand hoe and sprayers. They were completely dependent on Agali panchayat office for utilizing tractor facility. Realizing this, we took the initiative of converting this village into a 'Sustainable mechanized village' wherein we supplied a four wheel drive mini-tractor with the needed accessories like trailer, cultivator, rotavator, and other minor implements like brush cutter, sprayers, spade etc. (Fig. 8-10)

On-farm training and demonstration on the usage of these machineries were organized. The program was formally inaugurated by Dr Bakshi Ram, Director, ICAR-Sugarcane Breeding Institute, Coimbatore on 7 April 2015.

(T. Rajula Shanthy, T. Arumuganathan, A. Bhaskaran, R. Karuppaiyan, N. Rajendra Prasad and C. Jayabose)

Fig. 8. Dr. Bakshi Ram, Director, ICAR-SBI explaining tribal villagers about mechanization

Fig. 9. Distribution of mini tractor and accessories (Seated in the tractor is Dr Bakshi Ram, Director, SBI)

Fig. 10. Distribution of sprayers to tribal villagers

Other happenings

Foundation Day at ICAR-SBI RC, Agali

The 16th Foundation Day of ICAR-SBI Research Centre, Agali was celebrated under the leadership of Dr. Bakshi Ram, Director, ICAR-SBI on 7 April 2015 (Fig. 11). This Research Centre was established on the basis of the recommendations of the ICAR's Quinquennial Review Team (1982-87) and became operational from 7 April 1999. The mandate of the Centre is to maintain elite germplasm of sugarcane, to facilitate distant hybridization in sugarcane

Fig. 11. ICAR-SBI RC, Agali Foundation Day celebration

and to serve as national off-season nursery for banana, jute, etc. A total of 1647 germplasm is being maintained at the Centre which includes species clones of *Saccharum officinarum, S. barberi, S. sinense, S. spontaneum, S. robustum, S. edule, Erianthus arundinaceus, E. bengalensis, E. elephantinus, E. procerus, E. ravennae, Narenga* sp., *Neyrudia* sp. and *Sclerostachya* sp, inter-specific and inter-generic hybrids, improved officinarum and robustum, Co and Co allied clones, DUS reference varieties and exotic clones.

Dr. T.V. Sreenivasan, former Director of SBI and the first Scientist in-charge of Agali Centre was the Chief Guest. In his Inaugural Address, Dr. Bakshi Ram, Director, ICAR-SBI outlined the activities of the Centre and emphasized the need for strengthening marcotting facilities at the Centre for improving seed set in sugarcane crosses. The juice analysis facilities established at the Centre was also inaugurated in this occasion (Fig. 12).

Fig. 12. Inauguration of juice analysis facility at SBI RC, Agali

International Yoga Day

International Yoga Day was celebrated at the institute on 20 June 2015. Dr. D. Thilakavathy, Secretary, Integral Yoga Institute, Coimbatore was the Chief Guest and she spoke on 'Wellness lifestyle through yoga' wherein she stressed the importance of yoga in combating stress in everyday life with practical demonstrations (Fig. 13). Dr. Bakshi Ram, Director, ICAR-SBI presided over the function.

Fig. 13. Demonstration of Yoga during Yoga Day

Education

- Ms. K. Ramalashmi was awarded Ph.D. degree by Bharathiyar University on 28 May 2015 for her thesis on 'Expression analysis of sucrose genes in *Saccharum, Sorghum* and their hybrids' under the guidance of Dr. N.V. Nair, Director (Retired).
- Three Ph.D. scholars from Bharathidasan University, Tiruchirapalli have enrolled at the institute to conduct research in Biotechnology.

New projects initiated

- A Contract research project on 'Customized fertilizers on sugarcane' sponsored by M/s Nagarjuna Fertilizers and Chemicals Ltd., Hyderabad with an outlay of Rs.6,47,733.
- An innovative project on 'Standardization of true seed production technique through developing homozygous parental lines and apomixis'.

Scientific participation

S.No.	Programme	Scientist(s)
1.	Workshop on 'Making engineering scientists' contribution more meaningful to stakeholders and the nation' at National Agricultural Science Centre (NASC) Auditorium, New Delhi during 13-14 April 2015	Dr. T. Arumuganathan
2.	Review meeting of ICAR Institutes / Agricultural & Fisheries Universities and KVKs in Tamil Nadu at ICAR-CIBA on 9 May 2015	Dr. R. Viswanathan
3.	Joint conference of the Vice Chancellors and the Directors of the ICAR Institutes at NAAS Complex, New Delhi during 15-16 May 2015	Dr. Bakshi Ram
4.	81st Scientific Workers Conference 12 June 2015 at TNAU, Coimbatore	Dr. C. Palaniswami
5.	State Level Monitoring Committee meeting of Coconut Development Board at APC Office, Chennai on 25 June 2015	Dr. C. Palaniswami
6.	Town Official language Implementation Committee, Karnal at SBI-RC, Karnal on 19 June 2015	Dr. Neeraj Kulshreshtha
7.	Meeting for coding entries of AICRP (Wheat) at IIWBR, Karnal on 20 June 2015	Dr. Neeraj Kulshreshtha
8.	Consultation session with the sugar mills associations, sugar federations and sugar Institutions organized by Commission for Agricultural Costs and prices at Krishi Bhavan, New Delhi on 29 June 2015	Dr. Bakshi Ram

Institute Research Council meeting

The Institute Research Council meeting was conducted during 3-9 June 2015 under the chairmanship of Dr. Bakshi Ram, Director, ICAR-SBI. The progress of the ongoing research projects was reviewed and suggestions were offered for implementation in the ensuing year.

CeRA workshop

ICAR-Sugarcane Breeding Institute (SBI), Coimbatore organized a one-day J-Gate@CeRA User awareness workshop on 12 June 2015 (Fig. 14).

Fig. 14. Inauguration of CeRA Workshop

Dr. Bakshi Ram, Director of ICAR-SBI, Coimbatore in his Presidential address, complimented the efforts of CeRA in providing quick access to quality journals in the field of agriculture. Appreciating the initiatives of ICAR-DKMA in showcasing the important technologies of ICAR, Dr Bakshi Ram suggested that researchers should use the advanced search facility of CeRA for accessing information, rather than conducting searches through common search engines such as Google.

Dr Rameshwar Singh, Project Director, ICAR- Directorate of Knowledge Management in Agriculture, New Delhi was the Chief Guest and in his Inaugural Address said that CeRA has been successfully serving as an R&D information resource base for the Agricultural researchers of our country over the years. Ninety five scientific / technical staff of ICAR-Sugarcane Breeding Institute, ICAR-Central Institute for Cotton Research-Regional Station, ICAR-Central Institute of Agricultural Engineering-IEP and Tamil Nadu Agricultural University participated in the workshop. Urging the participants to make use of CeRA, Dr Singh mentioned that CeRA is the largest e-resource consortium in the country, after UGC-Infonet. The Document Delivery Request (DDR) is a unique feature of CeRA, he added.

Dr R.S. Rana, In-charge, CeRA, New Delhi coordinated the Interactive session of the workshop. This workshop conducted by Informatics India Ltd., Bangalore.

ICAR South Zone Sports Meet

A contingent with 47 members from ICAR-SBI participated in the ICAR Inter-Institutional Sports Tournament - 2015 (South Zone) hosted by ICAR-Central Institute of Fisheries Technology, Cochin during 25-29 May 2015 at Cochin. Dr. K.N. Raghavan, IRS, Commissioner of Customs, Cochin declared open the tournament in the Inaugural Function presided over by Dr. C.N. Ravishankar, Director, ICAR-CIFT, Cochin on 25 May 15. Shri T.C. Yohannan, Olympian and Arjuna Awardee was the Chief Guest of the Valedictory Function on 29 May 2015. The team from the institute bagged three bronze medals in the following events - 100 m race & 200 m race (women) by Smt. P. Seema and 800 m race (men) by Shri. P.C. Krishnakumar of SBI-RC, Kannur (Fig. 15 - 16).

Fig. 15. March Past by ICAR-SBI contingent

Fig. 16. Smt. P. Seema receiving medal from Director, ICAR-CIFT

Other meetings

- ICAR's 20th All India Entrance Examination for admission to UG and PG degree programs in Agriculture and allied sciences for the academic session 2015-16 during 11-12 April 2015
- Senior Officer Committee meeting during 20 May 2015 & 22 June 2015
- Selection Committee meeting for Walk in Interview of Project Fellow on 2 June 2015 & for Senior Research Fellow on 3 June 2015
- Grievance Committee meeting during 22 April 2015,13 May 2015 & 18 June 2015
- Quarter allotment Committee meeting on 14 May 2015
- IARI Ph.D. Entrance Examination 2015 on 7 June 2015

Appointments

- Ms. Lovejot Kaur appointed as Scientist (Biotechnology) in the forenoon of 10 April 2015
- Dr. R. Selvakumar, Senior Scientist (Plant Pathology) joined on 10 April 2015 on his transfer from IIWBR, Karnal.
- Dr. K. Nithya, Scientist (Plant Pathology) joined on 1 May 2015 on her transfer from IISR, Lucknow.
- Dr. A.J. Prabakaran, Principal Scientist (Plant Breeding) joined on 29 May 2015 on his transfer from IIOR, Hyderabad
- Smt. R. Mahalakshmi appointed as Lower Division Clerk in the forenoon of 15 May 2015
- Shri P. Vasudevan, TSL appointed as Skilled Support Staff w.e.f 23 May 2015

Promotions

- Dr A. Anna Durai, Senior Scientist promoted as Principal Scientist w.e.f 27 February 2014

Transfer

- Dr T. Manjunatha, Scientist (Plant Breeding) transferred to Indian Institute of Oilseeds Research, Hyderabad w.e.f 28 April 2015
- Dr. C. Karpagam, Senior Scientist (Agrl.Extension) transferred to SBI-RC, Karnal w.e.f 9 June 2015

Retirement

- Shri V. Gurunathan, Senior Technical Officer, retired from service on superannuation on 30 April 2015
- Shri S. Thangasamy, Technician, retired from service on superannuation on 30 April 2015
- Dr. S.D. Chandrasekar, Chief Technical Officer retired from service on superannuation on 31 May 2015
- Shri L. Selvarajan, Asst Chief Technical Officer, retired from service on superannuation on 31 May 2015
- Shri K.K.Venkatesan, Senior Technician, retired from service on superannuation on 31 May 2015
- Dr. S. Venkatramana, Principal Scientist retired from service on superannuation on 30 June 2015.
- Shri K.K. Hamza, Senior Finance & Accounts Officer retired from service on superannuation on 30 June 2015.
- Shri R. Krishnan, Skilled Support Staff retired from service on superannuation on 30 June 2015.

ICAR-SBI Quarterly Newsletter
Published by : Dr. Bakshi Ram, Director, ICAR-SBI, Coimbatore
Editors : Drs. T. Rajula Shanthy and Bakshi Ram
Fax : 0422 - 2472923 E-mail : info@sugarcane.res.in
Website : www.sugarcane.res.in

This Newsletter is available at www.sugarcane.res.in/news July 15. pdf
ISSN : 0973 - 8170
Printed at Prdag Print Coimbatore