



NRCPB NEWSLETTER

ICAR- National Research Centre on Plant Biotechnology,
Pusa Campus, New Delhi



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January–June 2015

FROM PROJECT DIRECTOR'S DESK

Agriculture and allied sectors are major sources of employment and livelihood security for majority of the Indian population. It has been reported that Indian population will surpass 1.6 billion by 2050. Although we have enough food grain production in the country, large sections of the population struggle to get two meals a day. Since it is a matter of great concern, Government of India has launched an ambitious food security mission to provide food to all including underprivileged. However, cultivable land is almost static, and a bottleneck. Therefore to circumvent this impasse, there is an urgent need to increase agricultural production in near future. Beside refinement of all agricultural inputs, biotechnological interventions could play a pivotal role towards sustainably improving agricultural productivity. Biotechnological interventions available in the public domain could expedite developing designer/ smart crops. Economically viable plant tissue culture techniques are becoming indispensable for mass multiplication of elite plant species in India. For instance, several Private companies have used this technology for multiplying superior cultivars of banana, pomegranate and sugarcane at a commercial scale. Overall this technology is not only providing high quality planting material to farmers, also employment to rural masses. Application of transgenic biotechnology for sustainable agricultural production is well established across the globe. This technology has been successfully employed for targeting various traits such as herbicide tolerance, insect-pest resistance, virus resistance, delayed fruit ripening, altered oil composition, nutritional enhancement, and male sterility and restoration systems. Indian farmers have benefited immensely from transgenic Bt cotton in which yield has taken a quantum jump from 13.6 million bales to 37.0 million bales within a short span of 11 years. This unparalleled increase in yield could be made feasible by the use of Bt (*Bacillus thuringiensis*) gene, which helped in controlling the dreaded cotton pest *Helicoverpa armigera*. Therefore, it is imperative to extend transgenic technology to taxonomically diverse and agronomically important crop species that are often subjected to various biotic and/ or abiotic stresses. Equally important is to educate and spread awareness among public about the efficacy and safety of this technology. During the last decade, genomics has taken a centre stage in plant biology research. Many national and international programmes were initiated on decoding the complete genomes of agriculturally important crop plants. The genome sequence information is very important in designing new DNA markers, performing comparative genomics, helps in rapid cloning and characterization of genes and their utilization in developing climate smart crop varieties. Although in some crops, biotechnological research has already been used for developing commercial products; still we have to reap the maximum benefit of many new technologies. Latest genome editing technologies like CRISPER-Cas (Clustered regularly interspaced short palindromic repeats), TALEN (transcription activator like effector nucleases) and Zinc finger nucleases hold great promise for crop improvement in future.

It is a matter of great satisfaction that ICAR-National Research Centre on Plant Biotechnology (ICAR-NRCPB) is bringing out Jan-Jun 2015 issue of the Newsletter. The editorial board has made special efforts to include major



highlights of various academic activities at ICAR-NRCPB during the first six months of the year. I would like to thank Chief Editor Dr. PK Mandal, and other members of the editorial board for their hard work and meticulous planning of all the contents and materials included in it. I would also like to place on record our sincere thanks to Dr S Ayyappan, Secretary DARE and DG, ICAR, Dr J S Sandhu, DDG (CS) and Dr J S Chauhan ADG (Seeds) for their continued support to the institute. I sincerely hope that it would be received well by the readers across different domains. Any critical comments and / or suggestions would be appreciated.

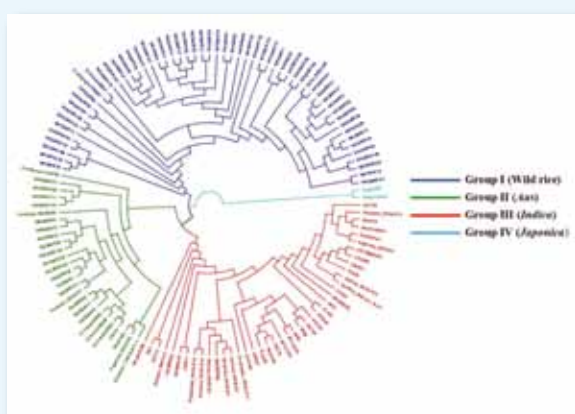
(T R Sharma)

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Single-copy gene based 50K “OsSNPNks” chip for genetic studies and molecular breeding in rice

‘Rice is native to India’ is the verdict by publishing our findings in the journal “Nature Scientific Reports”, have effectively proved that the rice varieties grown in India have actually originated in India not came from china. The 13-member team from ICAR-NRCPB, under the leadership of Prof. N.K. Singh, developed a unique DNA Chip with unique genetic probes which are embedded on the surface of a glass plate and when a suitable genetic mixture extracted from leaves of rice is poured, the wanted regions glow under special conditions. This would help the scientists to identify the presence or absence of the right gene combinations. The chip incorporates 50,051 SNPs from 18,980 different genes spanning 12 rice chromosomes, including 3,710 single-copy (SC) genes conserved between wheat and rice, 14,959 single-copy genes unique to rice, 194 agronomically important cloned rice genes and 117 multi-copy rice genes. Assays with this chip showed high success rate and reproducibility because of the SC gene based array with no sequence redundancy and cross-hybridisation problems. The usefulness of the chip in genetic diversity and phylogenetic studies of cultivated and wild rice germplasm was demonstrated. Furthermore, its efficacy was validated for analysing background recovery in improved mega rice varieties with submergence tolerance developed through marker-assisted backcross breeding. This chip was already deployed to develop a new resistant variant of Pusa Basmati-1 variety against ‘rice blast’ disease. The chip is also being used to develop varieties of rice against other biotic and abiotic stresses. This chip will be widely useful for analysis of genetic diversity, evolutionary studies, association mapping as well as diagnostics, fingerprinting and breeding applications.

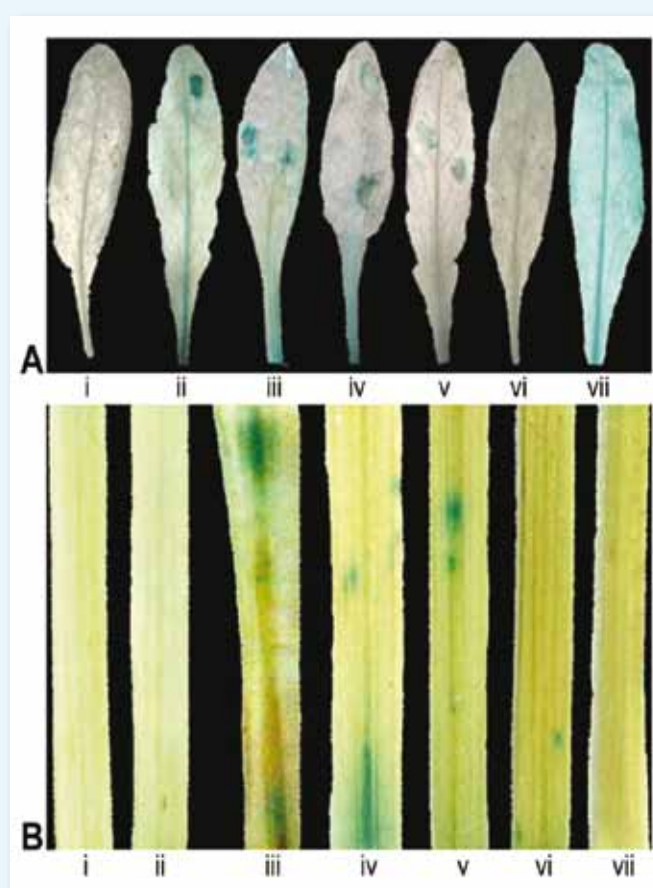


SNP haplotype-based neighbour-joining phylogenetic tree of 128 diverse rice genotypes, including wild rice, land races, improved cultivars and *Sub1* backcross derivatives of mega rice varieties. Four major distinct groups are: wild rice with ‘*sathi*’ (blue), wild rice with *Aus* rice cultivars (green), wild rice with *Indica* rice cultivars (red) cultivars and *Japonica* (cyan) rice cultivars.

Cloning and functional validation of early inducible *Magnaporthe oryzae* responsive CYP76M7 promoter from rice

Crops, specifically of agronomic importance, are more

vulnerable to various biotic and abiotic stresses. Among them, rice blast is the most serious threat to the cultivated rice all over the world. With the development of various molecular biology tools, the resistance breeding approach which depended heavily on classical breeding methods has gained enormously in terms of time and precision in developing resistant rice plants. Till-date around 22 rice blast resistance genes have been cloned and characterized, but unfortunately there is not much work on the promoters which govern their expression in their native system. Cloning and characterization of pathogen inducible promoters is as significant as cloning a resistant gene. This is mainly due to the associated yield penalty with constitutively expressing *R*-genes. Recently at ICAR-NRCPB, a *CYP76M7* gene promoter, induced by *Magnaporthe oryzae*



GUS Histochemical assays for functional validation of different *CYP76M7* promoter. A) *Arabidopsis* mock inoculated i) P_{cyp2004}; and *M. oryzae* challenged ii) P_{cyp2004}; iii) P_{cyp1456}; iv) P_{cyp1167}; v) P_{cyp520}; vi) P_{cyp222}; vii) constitutive 35 S promoter (positive control) plants. B) transient expression in rice leaves bombarded with i) pBI 101 empty vector; ii) mock inoculated P_{cyp2004}; and *M. oryzae* challenged iii) P_{cyp2004}; iv) P_{cyp1456}; v) P_{cyp1167}; vi) P_{cyp520}; vii) P_{cyp222}.

has been cloned from indica rice line HR-12 and it was further functionally validated both in rice as well as *Arabidopsis* plants. *CYP76M7* promoter is inducible by *M. oryzae* both in monocot and dicot plants and is conserved among crop species. This finding from ICAR-NRCPB will be of great significance and the *CYP76M7* promoter can be used for regulated expression of resistance genes so as to manage rice blast disease very effectively.

EVENTS

Rabi (Mustard) Field Day

On 10 February 2015 Rabi (Mustard) field day was organized at ICAR-NRCPB. All the staff and Students of the ICAR-NRCPB participated and visited the mustard research field, polyhouse and net houses. Dr. S. R. Bhat showed the unique collection of over 25 wild allied species which is maintained at NRCPB and how they are being utilized in *Brassica* improvement through inter-specific and inter-generic hybridization. He showed the cytoplasmic male sterile (CMS) and fertility restorer lines of mustard and cauliflower and described how it is utilized in the hybrid program. He also explained the molecular mechanism of CMS and its restoration in plants. Dr. Mahesh Rao showed and described the ongoing research for widening of mustard diversity by resynthesis of *B. juncea* from its parental species. He also showed the introgression of *Alternaria* resistance from wild species into mustard and their screening in epiphytotic condition. Also, the product developed from the ICAR-NRCPB as varieties like Pusa Jaikisan and Pusa Gold, white rust resistant germplasm as Bio-YSR, several stable synthetic mustard lines, mutant collection and new experimental hybrids were on display and explained by the concern researchers.



Rabi (Mustard) Field Day organized on 10 Feb 2015

Foundation Day Celebration

For the first time ICAR- NRCPB celebrated its foundation day on 15 January 2015 after thirty years of its establishment. Dr. C. R. Bhatia, former secretary DBT was the chief guest of the function. The function started with the newly composed invocation song of the institute and presentation by our Project Director Dr. T. R. Sharma about the institute's achievements.

All the former Professors, Directors and retired staff of NRCPB was felicitated on the occasion. A debate competition on "Genetic engineering of crops is an efficient solution for attaining long term food security" was organized as a part of the celebration and students from across the Institutes in Delhi participated in it. A grand cultural programme was organized by the students and staff of ICAR-NRCPB which was memorable.



Foundation Day celebration at ICAR-NRCPB on 15 Jan 2015

Foundation Day Lecture

In continuation to the foundation day celebration, Prof. V. L. Chopra, founder Director of ICAR-NRCPB and Former Secretary DARE and DG ICAR delivered the first foundation day lecture on "Plant adaptation to weather extremes: Genetic plasticity and metabolic trickery" on 30th March 2015. The function was Chaired by Padma Bhushan Dr. R. B. Singh, Chancellor, Central Agricultural University, Imphal. Prof. Chopra explained about the various weather extremes and how plants physiologically and metabolically adapt themselves to these extreme climatic conditions in his thought provoking lecture.



First Foundation Day Lecture delivered by Prof. V.L. Chopra



Felicitations of Prof. V.L. Chopra by Prof. R.B. Singh

Swachha Bharat Abhiyan

In continuation to our regular and sustained efforts to keep our surroundings clean, as a part of the Swachha Bharat Abhiyan, all students and staff of ICAR-NRCPB participated in the swachhata awareness drive organized by ICAR on 01 January 2015 surrounding the PUSA campus. Subsequently a meticulous Monthly, Yearly and Five Yearly plan have been prepared for Swachhata Abhiyan to keep ICAR-NRCPB clean.



Students and staff of ICAR-NRCPB participating in Swachhata Abhiyan on 01 Jan 2015

Institute Management Committee (IMC) meeting

IMC meeting was held at ICAR-NRCPB on 23 February 2015 under the chairmanship of Dr. T.R. Sharma. Other members present were Mr. A.P. Siani, Dr. Kuldeep Singh, Dr R.D. Rai, Dr Sushma Chapalkar, Dr Anil Sirohi, Dr Dinesh Kumar, Dr T. Mohapatra, Dr Aleka Vani, Dr J.S. Chauhan and Mr. Vampad Sharma. Prof. N.K. Singh, Dr. Srinivasan, Dr. S.R. Bhat and Mr. Mohan Singh were special invitees.



IMC meeting held at ICAR-NRCPB on 23 Feb 2015

Institute Research Committee (IRC) meeting

IRC meeting was held on 1 May 2015 under the chairmanship of Dr. T. R. Sharma. All scientists of the institute presented their project achievements and activity and the future project targets. The progress of the project was reviewed by Prof. M. L. Lodha and Prof. R. P. Sharma as external experts, who gave their valuable inputs.



IRC meeting held on 01 May 2015 under the Chairmanship of Project Director

INTERNATIONAL WOMENS' DAY CELEBRATION

ICAR-NRCPB celebrated INTERNATIONAL WOMENS' DAY on 09 March 2015. On this occasion, the Chief Guest of the function Dr Anita Srivastava, Medical Officer Incharge, Indian Agricultural Research Institute, New Delhi delivered a talk on 'Women Health: Fitness and Preventive Measures' for the benefit of the women staff including RA/SRF. The talk was followed by an interactive session during which the participants discussed issues related to women health with the chief guest.



International Womens' Day Celebration at ICAR-NRCPB

NEW PROJECTS

S. No.	Title of Project	PI	Sanction date	Grant amount
1	Understanding cellular and genetic mechanisms and identifying molecular markers for seed viability in soybean (NASF/ICAR)	Dr Kishor Gaikwad	June 2015	Rs. 59.84 Lakh
2	Referral Lab for NCS-TCP project on Genetic Fidelity Testing (DBT)	Dr Amol Solanke	March 2015	Rs. 71.37 Lakh

OUTREACH

Visit of School / college students

More than eight hundreds students from agricultural universities, different colleges and Schools visited ICAR-NRCPB. They visited different labs and, interacted with scientists about biotechnology and the current research undergoing at this institute.



Visit of Students from different Universities, Colleges and Schools

MoU / MTA signed

- ICAR-NRCPB signed Memorandum of Understanding (MoU) with M/S Ganga Kaveri Seeds Pvt. Ltd., Hyderabad on 02 March 2015 for licensing of *cry1Fa1*, *cry2Aa* and *cry1Ac-F* genes.
- To facilitate further development in hybrid research, ICAR-NRCPB signed Material Transfer Agreement (MTA) on 27 May 2015 with Division of Vegetable Science, ICAR-IARI, New Delhi for transfer of CMS system in cauliflower background.

Patents filed

- A complete patent application entitled "Polynucleotide fragment for generating blast tolerant plants, methods and uses thereof" was filed by Dr. T.R. Sharma on 20 Feb 2015. (Application no. 782/DEL/2014)
- A complete patent application entitled "Pathogen inducible promoter from rice and uses thereof" was filed by Dr. T.R. Sharma on 20 Feb 2015. (Application no. 783/DEL/2014)
- A provisional patent application entitled "Target genes in aphids for host-delivered RNAi mediated gene silencing and their application for developing aphid resistance in plants" was filed by Dr. R. C. Bhattacharya on 18 June 2015 (Application No. 1817/DEL/2015)

Training

ICAR sponsored summer school was conducted at NRCPB on "RNA-interference in Plant Functional genomics and Crop Improvement" during 6-26 May 2015. Twenty five faculties/scientists from different State Agricultural Universities and ICAR institutes of India participated in this training.



Summer School held at ICAR-NRCPB from 06-26 May 2015

ICAR-NRCPB conducted DBT sponsored training on “Non-radioactive method of gene detection in microbes/GM crops” from 16-21 Feb 2015 and there were ten participants from different parts of India.



DBT sponsored training on Non-radioactive method of gene detection

Display & Video

NRCPB has taken major initiatives through various institutional committees towards showcasing the importance



DVD on 'NRCPB Marching Ahead'

of Biotechnology in Agricultural Research and significant contributions of the centre. In this direction, to sensitize students and visitors, photographs of twenty five eminent scientists throughout the world along with their contributions in brief are displayed at various places of the centre. Significant achievements of ICAR-NRCPB were displayed in the form of posters. ICAR-NRCPB has made a new video film titled as 'NRCPB Marching Ahead'.

Extension Activities

ICAR-NRCPB also published the major achievements as Success Story (both in Hindi and English) in the form of pamphlets. Two extension bulletins (in the form of folder) were also published both in English as well as in Hindi on Transgenic Crops.

The centre has also participated in Pusa Krishi Vigyan Mela during 10-12 March 2015; organized by ICAR-IARI, New Delhi. All Scientific and Technical staffs of the centre participated in the function and interacted with farmers, students and other visitors at ICAR-NRCPB stalls.



ICAR-NRCPB stall at Pusa Krishi Vigyan Mela

VISITS AND EXCHANGES

International Visitors:



UAE team Visit

- ◆ On 8th January 2015, a group of eight students from United Arab Emirates University, UAE visited ICAR-NRCPB.
- ◆ A delegation of six members from OCP Foundation, Morocco visited our centre on 9th February, 2015.
- ◆ A ten member delegation from South Africa visited ICAR-NRCPB on 27 February, 2015.

National Visitors:

- ◆ The ARS attachment trainees in Delhi visited ICAR-NRCPB on 08 May 2015.
- ◆ A delegation from Assam Agriculture University visited ICAR-NRCPB on 21 April 2015.

AWARDS AND HONOURS

- ♦ **Sanjay Singh** received Bioved Fellowship Award 2015 by Bioved Research Society of Bioved Research Institute of Agriculture & Technology, Allahabad for outstanding contribution in the field of Genetics, Plant Breeding and seed production.
- ♦ **Sanjay Singh** received Eminent Scientist Award 2014 by National Environmental Science Academic for outstanding contribution in the field of Genetics and Plant Breeding, on 22 Feb 2015.
- ♦ **Rohini Shreevathsa and Amolkumar U. Solanke** received Award of Excellence in Genetic Engineering and Eminent Plant Biotechnologist 2015 respectively

of Society for Plant Biotechnology from Hon'ble Chief Minister of Puducherry, Mr. N. Rangasamy in SAB International Symposium: New Perspective in Modern Biotechnology, Puducherry.

Publication

Type of Publication	Number
Research Papers	27
Book chapters	07
Popular Articles	01

INVITED TALKS

1. **Dr Ajay Jain** delivered a talk on 'Arabidopsis MYB-related Transcription Factor *HHO2* Plays a Role in the Maintenance of Phosphate Homeostasis: Evidence for its being Partially Epistatic to *PHR1* and *SIZ1*' on 26 Jun 2015 at Purdue University, USA.
2. **B.L. Patil** Delivered a talk on "Effect of Light and Temperature on Virus Infections, Gene Silencing and their implications on Virus Induced Gene Silencing (VIGS)" 2nd International Conference on Biotechnology and Bioinformatics (ICBB-2015), organised by ICSCCB (International Centre for Stem Cells, Cancer & Biotechnology), Pune, from 6-8 Feb 2015.
3. **J. C. Padaria** delivered a talk on 'Transformation of wheat for development of thermo tolerant transgenic wheat In
4. **P. K. Dash** delivered a talk at National conference on Biodiversity and crop protection, Shobhit University, Meerut on 8-9 May 2015.
5. **Amolkumar U. Solanke** delivered a talk on 'Use of genomics approaches for understanding the diversity in fruit size, shape and colour in Brinjal (*Solanum melongena* L.) varieties', at National Conference on Approaches Towards Protection of Biological Resources held at Shobhit University, Meerut 8th May 2015.

हिन्दी गतिविधियां

वर्ष 2015 के दौरान आयोजित हिंदी के कार्यक्रमों का बयौरा :

वर्ष 2015 की दो तिमाही के अंतर्गत दिनांक 28 फरवरी 2015 एवं 25 अप्रैल 2015 को हिंदी राजभाषा कार्यालय समिति की बैठकों का आयोजन केंद्र में सफलता पूर्वक किया गया। इस दौरान दो कार्यशालाओं का आयोजन किया गया जिनका विवरण निम्न प्रकार से है।



केंद्र में हिन्दी कार्यशालाओं का आयोजन

क्रम संख्या	दिनांक	तिमाही	व्याख्यानकर्ता
1	31 जनवरी 2015	जनवरी-मार्च	डॉ रमेश सपरा, पूर्व प्रधान वैज्ञानिक, भा०कृ०अनु०सं०, नई दिल्ली
2	27 अप्रैल 2015	अप्रैल-जून	प्रो० श्रीनिवासन, पूर्व प्रधान वैज्ञानिक, रा०पा०जै०प्रौ०अनु०कें०, नई दिल्ली

STUDENTS' SECTION/NRCPB BIOTECH CLUB

Biotech Club organized a talk on 20 January 2015 which was delivered by Dr. Ravi Maruthachalam, IISER, Thiruvanthapuram. He delivered his talk on "Centromeres and parental genome conflict in plants".

A farewell function was also organized by Biotech Club to felicitate the MSc and PhD students of MBB discipline who received their degrees in 53rd convocation of IARI. During the occasion all degree recipients shared their experiences.



Felicitations of MBB students after receiving their Degree in 52nd Convocation of ICAR-IARI

PERSONNELIA

Promotions:

Dr. SR Bhat joined as Professor, Molecular Biology and Biotechnology on 23 April 2015. Dr. Bhat is working at ICAR-NRCPB since 1995 and made significant contribution in *Brassica* improvement.



Dr. Kishor Gaikwad and **Dr. Sharmistha Barthakur** are promoted to Principal Scientist through CAS.

New Staff:

Mr. Deepak Singh Bisht and **Mr. Anshul Watts** joined NRCPB on 09 April 2015 as scientists. Both worked with Dr. SR Bhat for their PhD research.

Transfers:

Dr. P. Ananda Kumar gets transferred from ICAR-NRCPB to Indian Institute of Rice Research, Hyderabad on 29 Apr 2015. Before this he was on deputation at ANGRAU, Hyderabad.

Mr. Vampad Sharma, Senior Administrative Officer (SAO) gets transferred to ICAR head quarter as Under Secy. (Per.) on 17 Jun 2015.

Retirement:

Dr. Srinivasan retired as Professor, MBB after serving 35 years at ICAR. He was born in Varanasi in 1953 and obtained Ph.D. from Banaras Hindu University. He joined ICAR-IARI through ARS in 1977. He served for the ICAR-NRCPB from its inception. Dr. Srinivasan has contributed significantly in the area of Plant Biochemistry and Molecular Biology. He was leading 'Isolation of Plant Genes and Promoters' research group at ICAR-NRCPB. In 2010 he joined as Professor and from 2012-14 acted as Project Director. ICAR-NRCPB family wishes him a happy, healthy and peaceful retired life.



FORTHCOMING EVENTS

- ◆ Research Advisory Committee meeting of ICAR-NRCPB: 20th July, 2015
- ◆ National Symposium on "Germplasm to Genes: Harnessing Biotechnology for Food Security and Health" in association with Society of Plant Biochemistry & Biotechnology: 9-11 August 2015.
- ◆ Felicitation of New PG School Students
- ◆ Hindi Chetna Saptah
- ◆ *Kharif* Field Day

Credit lines:

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