DRR

Directorate of Rice Research

Newsletter

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ICAR-IRRI Work Plan Agreement Signed

Joining hands to fight hunger ...

An agreement between the International Rice Research Institute (IRRI) and the Indian Council of Agricultural Research (ICAR) was signed on 20 January 2009 at New Delhi which will support and strengthen India's rice research during the next four years. Further, it ensures India's continued involvement in frontier rice research along with other countries around the globe. The work plan includes agreements on major projects supported by the Bill & Melinda Gates Foundation: Stress-tolerant rice for poor farmers in Africa and South Asia (STRASA); the Cereal Systems Initiative for South Asia (CSISA); Creating the second green revolution by supercharging photosynthesis: C_4 rice and several other on-going research projects. The work plan agreement for the period 2009-12 was signed by Dr. Mangala Rai, Secretary, DARE and Director General, ICAR and Dr. Rober Zeigler, Director General, IRRI, Philippines.

As a follow up to this agreement, a multidisciplinary team of scientists from IRRI led by Dr. Achim Dobermann, DDG (Research), IRRI, visited DRR on 28th January 2009 and held discussions on various aspects of collaborative research between the two institutions.

Four DRR varieties released

Catering to growers' needs...

Four new varieties developed at DRR were released by CSCCSN&RV for cultivation across the country.

Akshaydhan (IET 19367), a medium duration variety (135 days), is released for cultivation in the states of Jharkhand, Andhra Pradesh, Tamil Nadu and Karnataka vide notification no. S.O. 2458 (E) dt. 16.10.2008. It has the yield potential of 60-70 quintals/ha and has recorded 25% more yield than Jaya and 17% over KRH-2 hybrid. It has long bold grains with intermediate amylose (24%) and ASV (5). It is resistant to neck blast and moderately resistant to tungro, sheath rot, brown spot and white backed plant hopper. This variety is the byproduct of parental line improvement under the hybrid rice breeding programme.

Varadhan (IET 18940), a mid-early duration variety (125 days) is released for Haryana, Uttarakhand, Jharkhand and Uttar Pradesh vide notification no. S.O. 2458 (E) dt. 16.10.2008.

It has the yield potential of 60-70 quintals/ha and has recorded 18% more yield than IR64 and 9% more than PA 6201 hybrid. It has short bold grains with intermediate ASV (5).

Improved Sambha Mahsuri (IET 19046) is the first product of Marker Assisted Selection (MAS) from DRR and has three bacterial leaf blight (BB) genes *xa5, xa13* and Xa21 incorporated in the background of the most popular variety BPT 5204. It is released for cultivation in the states of Andhra Pradesh, Chattisgarh, Orissa, Jharkhand, Bihar, Gujarat and Maharastra vide notification no. S.O. 1108(E) dt. 08.5.2008. It is almost similar to Samba Mahsuri in yield, grain and cooking quality and agro-morphological traits besides having resistance to BB and is also being widely used by various rice breeders across the country as an elite donor material for BB resistance breeding.

'Improved Samba Mahsuri' (a&b) has excellent grain quality (d&f) similar to Samba Mahsuri (c&e)

Sampada (IET 19424), a medium duration variety (135 days) is released for cultivation in Bihar, Chhattisgarh, Maharastra, Tamil Nadu and Kerala vide notification no. S.O. 2458 (E) dt. 16.10.2008. It has the yield potential of 65-70 quintals/ha and recorded 24% more yield than BPT 5204. It has medium slender grains with intermediate amylose (23%) and ASV (5). It is tolerant to blast, tungro disease and white backed plant hopper.

INSTITUTIONAL ACTIVITIES

Awards and Recognition

DRR Scientists Honoured

You have done us proud ...

Basmati rice breeders of DRR Dr N. Shobha Rani, Principal Scientist & Head, Crop Improvement and Dr A.S. Hari Prasad, Senior Scientist, Crop Improvement Section, along with Dr E.A. Siddiq, former Project Director (DRR) & Deputy Director General (retired), ICAR and Dr M.V.S. Sastry, Principal Scientist (retired), were felicitated by Sri Sharad Pawar, Honorable Union Minister of Agriculture, in a function held at New Delhi on 16.2.09 for their significant contribution and outstanding service to the nation which ushered in Basmati rice revolution and rich economic benefits to the farming community.

Drs. N. Shobha Rani, Vijai Pal Bhadana, Brijendra and B.C. Viraktamath received the Best Paper award for their paper entitled "Status, conservation and Strategies for Improving Rice in *Jhum* areas of NEH region through Holistic Approaches" presented at National Seminar on "Sustainable Hill Agriculture" held at ICAR Research Complex for NEH Region, Manipur Center, Lammphelapat, Imphal, during 28th February - 2nd March 2009.

Ms. B. Nirmala has been conferred 'Young Scientist Award' and 'Best Paper Award' for her paper entitled 'WTO agreement on agriculture and its implications to India' in the International Seminar on WTO and its Impact on Agricultural Trade, organized by Green Cross Society, Agra during 13-14 February 2009.

Institute Management Committee (IMC)

IMC of DRR held its 14th meeting on 21.2.2009 under the chairmanship of Dr. B.C. Viraktamath, Project Director, DRR. New members of the committee, namely Dr. G. Lakshmi Kantha Reddy, Director of Research, ANGRAU; Dr. B.N. Reddy, Principal Scientist, DOR; Dr. K.S. Vara Prasad, Head, NBPGR Regional Station, Hyderabad; Shri V. Krishna Rao, Farmer's Representative nominated by ICAR; Shri C. Bhagaiah, Finance & Accounts Officer i/c, NAARM attended the meeting. The committee reviewed the progress of work done at DRR and discussed various aspects including purchase of new vehicles, transport facilities for staff, construction of parking sheds and offering specialized training programmes for post graduate students.

Research Advisory Committee (RAC)

The newly constituted RAC for DRR held its first meeting on 23.2.2009 under the chairmanship of Dr. P. Raghava Reddy, Vice Chancellor, ANGRAU, Hyderabad. Other members of the committee are Dr. J.L. Dwivedi, Sr. Rice Breeder, NDUAT, Faizabad; Dr. N.K. Singh, Pr. Scientist, NRCPB, New Delhi; Dr. K.S. Rao, Pr. Scientist, CRRI, Cuttack and Dr. K. Krishnaiah, former Director, DRR, Hyderabad. Dr. T.K. Adhya, Director, CRRI, Cuttack was the special invitee. The committee reviewed the progress & research at DRR and under AIRCIP and gave guidance for fututre research activities The RAC Chairman and other members also addressed all the scientists and conveyed their appreciation for the productive research being carried out at the institute.

Project on "Improving the Livelihoods of SC/ST Farmers" Launched

Changing lives with rice technologies....

A DBT funded project on "Improving the Livelihoods of SC/ST Farmers through Rice Technology Interventions" was launched on 31st January 2009 jointly by the Directorate in collaboration with the Youth for Action - Krishi Vigyan Kendra at Madanapuram, Mahaboobnagar district. Dr. BC Viraktamath, Project Director, DRR emphasized that the project aims to provide a cafeteria of technologies for the SC/ST farmers in the target areas that would help in improving their livelihoods. Dr. G.M. Lingaraju, Task Force Member Secretary, DBT, New Delhi along with Drs. Shaik N. Meera, Principal Investigator, DRR, E. Venkataramanayya, Chairman, YFA-KVK, Ajit Kumar, Joint Director of Agriculture, Mahaboobnagar and J.S. Prasad, Principal Scientist, DRR, also spoke on the occasion.

Workshop on Rice Knowledge Management Portal

Harnessing the power of knowledge ...

A workshop on the proposed 'National Agricultural Innovation project-Rice Knowledge Management Portal (NAIP-RKMP) was organized at the Directorate on 9th January, 2009 to workout

the modalities for the implementation of the project. It was inaugurated by Dr N.T. Yeduraju, National Coordinator, NAIP, New Delhi and was attended by various CoPIs from Consortium partner institutes. Dr B.C. Virakthamath, Project Director, DRR and the Consortium leader assured that RKMP will serve as a model for other crops in near future. Drs. Shaik N.Meera, Consortium Principal Investigator, D. Rama Rao, Head Information and Communication Management Division, NAARM; Sreenath Dixit, Principal Scientist, CRIDA, Hyderabad, and V. Balaji, Head, KMS- ICRISAT made brief presentations and gave suggestions for improving the project proposal.

Meeting on Registration of Extant Notified Varieties

Know to protect your varieties…

One day meeting cum workshop on Registration of Extant Notified Varieties (ENV'S) of Rice under PPV&FRA was organized at DRR on 4th March, 2009, for co-operating scientists of AICRIP. Dr. B.C. Viraktamath, Project Director, emphasized the importance of registration of the Extant Notified Varieties, New varieties and also genetic stocks. Several issues related to the filling and filing of applications of Extant Notified Varieties for registration with PPV&FRA were discussed. Thirty one rice breeders from different parts of the country participated in the workshop. Dr. N. Shobha Rani and Dr. L.V. Subba Rao facilitated the discussion and helped the cooperators to fill the forms.

ICAR- South Zone Sports Meet

All work and also play…

The 23 member team from DRR participated in ICAR South Zone IV tournament held at Sugarcane Breeding Institute, Coimbatore during 18th-26th January, 2009 and won the following medals: Dr. Chitra Shankar – Shuttle doubles (Silver) & Shot put (Bronze); Dr. K Surekha- Table Tennis singles (Silver); Ms. Kousalya – Chess (Silver) & Shuttle doubles (Silver). Dr. V. Ravidrababau led the team as manager.

Training Programmes

DRR organized ICAR sponsored 10 days Short Course on 'Site Specific Integrated Nutrient Management in Rice and RBCSs' during 4-13th February 2009. 16 Scientists from 10 states participated in the program. Dr. K. V. Rao, Principal Scientist (Soil Science) was the Course Director.

DRR organized 6 days training program on "System of Rice Intensification" for the officials and farmers of Sikkim sponsored by Govt. of Sikkim during 18-23rd March 2009. Thirty five persons were trained under this programme.

Participation in Symposia/workshops

Dr. S. P. Singh, PS (Agronomy) and Dr. P. Muthuraman, Sr. Scientist (Extension) attended a workshop on "Network Project on gender issues in rice-based production system and 'refinement of selected technologies in women prospective" at NRCWA, Bhubaneshwar during 29-30th Dec, 2008.

Dr. Shaik N. Meera, Sr. Scientist (Extension) attended a Workshop on "Crop Knowledge Models and Agropedia" At NAAS, New Delhi during 12-13th Jan, 2009.

Dr. N. Somasekhar, Sr. Scientist, delivered invited lectures in the "National Symposium on Non-chemical insect pest management" held at Entomology Research Institute, Loyola College, Chennai, during Feb 5-6th, 2009 and the International congress of global warming on insects: Management and conservation" organized by Bharatiyar University, Coimbatore, during February 9-12th, 2009.

Dr. M .Mohan, Sr. Scientist (Entomology) attended DST sponsored Workshop on "Commercialization Strategies" at FICCI, New Delhi during 5- 6th March 2009

Dr. B. C. Viraktamath, Project Director presented a paper at the 'National Seed Congress' organized by the University of Agricultural Science, Bangalore during 22nd Dec, 2008.

Dr. B. Sreedevi, Scientist (SS) (Agronomy) participated in the 96th Indian Science Congress held at Shillong during 3-7th Jan, 2009.

Drs. B.C. Viraktamath, Project Director, R. Mahender Kumar, PS (Agronomy) and M.S. Ramesha, Sr. Scientist (Hybrid Rice) participated in 4th World Congress on Conservation Agriculture held at NAAS, New Delhi during 4-7th February 2009.

Drs. N. Shobha Rani and L.V. Subba Rao, Principal Scientists attended a Seminar on 'Maintenance of pure stock of genotypes and plant varieties' organized by PPV&FRA at New Delhi on 12th February 2009.

Participation in Trainings/Winter schools

Dr. M. Mohan, Sr. Scientist (Entomology) and Dr. Satendra Kumar Mangrauthia, Scientist (Biochemistry) attended the Winter School on Biosecurity and biosafety: Policies, procedures and issues" organized by NBPGR, New Delhi on Feb 14th- Mar. 6th , 2009.

Mr. Ezra, Tech. Asst (Library) participated in 'Kishi Prabha: Indian Agricultural Doctoral Dissertations Repository – Workshop cum Training' under NAIP organized by CCSHAU library at Hissar, Haryana during 24-25th February 2009.

Dr. R. M. Sundaram, and Dr. Vandna Rai, attended a Hands-on Training Course on 'Basic Techniques for Studying Epigenetic Inheritance' organized by Center for Cellular & Molecular Biology, Hyderabad during February 25-10th March 2009.

Dr. D. Venkateshwarulu, Tech. Officer (Hindi) and G. Krishna, AAO attended a Training Programme on Official Language Management organized by Bharatiya Bhasha Sanskruti Sansthan at Dwaraka & Somnath, Gujarat during 19-21st February 2009.

DRR Participated in the Southern Regional Agricultural Fair-2008 organized by ANGRAU at Hyderabad during 20-23rd Dec, 2008.

Deputations Abroad

Dr. B. C. Viraktamath, Project Director and Dr. R.M. Sundaram, Sr. Scientist (Biotechnology) participated in Golden Rice Network Review Meeting held at IRRI, Philippines during 18-20th March 2009.

Dr. M.S. Ramesha, Sr. Scientist (Hybrid Rice) attended the 3rd Annual Review and Planning meeting of the ADB funded project on 'Developing and disseminating water saving rice technologies in South Asia' held at IRRI, Philippines. 16-20th February 2009.

Personalia

Appointmetns/Promotions/Transfers

Three Senior Scientists: Drs. L.V. Subba Rao, R. Mahendrakumar and D. Subramanium were promoted as Principal Scientists.

Four Scientists (SS): Drs. B. Sreedevi, R. M. Sundaram, P. Raghuveer Rao and M. Seshu Madhav were promoted as Senior Scientists.

Two Scientists Er. P. Hemasankari and Dr. Shaik N. Meera were promoted as Scientist (SS)

Fifteen technical staff: Sri. P.M. Chirutkar, Sri. Y. Roseswara Rao, Sri E.Nagarjuna, Sri. Tahseen, Sri. A. Narasing Rao, Sri J. Jagannath Rao, Sri Anantha Reddy, Sri Vittalaiah, Sri Sadath Ali, Sri Shravan Kumar, Sri K. Ramulu, Sri M.Vijay Kumar, Sri Janardhan, Sri Nagabhushnam and Sri V. Srinivasa Rao were promoted to the next higher grade.

Distinguished Visitors

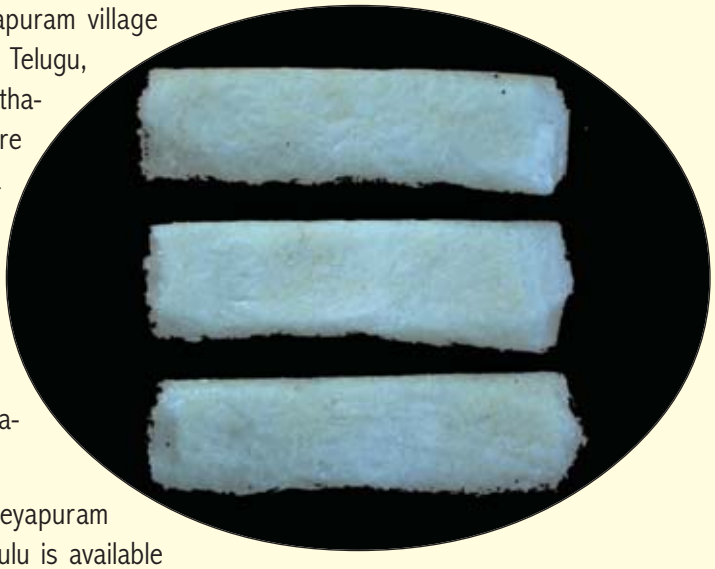
A team of IRRI scientists led by Dr. Achim Dobermann, DDG (Research), IRRI visited DRR on 28th January 2009. Other Scientists in the team were Dr. Parminder Virk, Dr. Fangming Zie, Dr. Serge Savery and Dr. Finbar Horgan.

Dr. Noel Magor, Head, Training Center, IRRI & Dr David Shires, E Learning Consultant to IRRI visited DRR and had discussions regarding RKMP and rice knowledge hub on 19th March 2009.

RICE RECEPIES

Pootha-Rekulu (Rice Wafers)

Soft and sweet rice wafers just melt in mouth...



Pootha-rekulu is unique traditional rice recepie from Aatreyapuram village near Rajahmundry, East Godavari District, Andhra Pradesh. In Telugu, *pootha* means "coating" and *reku* means a "sheet or foil". Pootha-rekulu are nothing but very thin rice sheets coated with a mixture of sugar and ghee. These are prepared by boiling rice to a gruel consistency and smearing the gruel on the base of an inverted heated earthen pot to set in a layer. The layer is carefully removed after it is dried. In the second step, powdered sugar is applied along with ghee and cardomom powder between extremely delicate layers of rice sheets. The sugar coated sheets are carefully rolled to form a roll of "pootha-reku".

Pootha-rekulu making is an art and every household in Aatreyapuram village has mastered it. Unlike many other sweets, pootha-rekulu is available only in select shops in India and is also exported to other countries. According to a news report, next to "Tirupati laddu", AP biodiversity board and AP technology development services is planning to get "Aatreyapuram pootha-rekulu" included in the Geographical Indications (GI) Registry.

GLOBAL RICE NEWS

IRRI publications go digital

IRRI publications (books, photos and videos) can now be accessed online through Google Book Search (GBS) via URL: http://books.irri.org. IRRI has been posting full-text versions of more than 350 publications for which it owns the copyright. IRRI made all their copyrighted titles 100% viewable and searchable on GBS. It also allows the users to download book PDFs from their site. In addition to placing books on GBS, IRRI has placed some 4,500 images on the public photo management facility, Flickr and some 60 videos on YouTube. IRRI books and photos made available via GBS and Flickr gives access to audiences that have been difficult to reach using traditional methods.

Agricultural Research Institute, Patna (Rajendra Agricultural University, Pusa, Bihar)

Agricultural Research Institute, Patna was established during the second five year plan in the year 1955 to cater to the needs of farmers of Patna and Gaya region which was subsequently brought under the administrative control of the Rajendra Agricultural University (RAU). It is located at $25^0$30'N latitude and $85^0$15'E longitude at an elevation of 57.8 m above MSL. The major soil type is heavy clay (Alluvial) and contains medium to high organic matter. Average annual rainfall of the location is 1136 mm.

Significant Achievements

A total of 29 rice varieties developed/evaluated by this institute were released for cultivation in this zone (listed in table). Among these, Sita, Mahsuri, Kanak Radha, IR 36 and Sugandha Rajendra Mahsuri-1 Rajendra, Sweta and Pankaj are popular. RAU 448 and RAU 498 are good in Boro season.

Sl.No.	Name of variety	Year of release	Duration (Days)	Height (cm)	Grain type	Ecosystem of cultivation	Av. yield (Qt/ha)
1	Cauvery*	1971	105-110	80-90	MS	Upland	30-40
2	Bala*	1971	105-110	80-90	SB	Upland	35-45
3	Ratna*	1971	120-125	80-90	LS	Upland	35-45
4	IR 20*	1971	130-135	90-100	MS	Medium land	40-50
5	Mahsuri*	1971	140-145	120-130	MS	Medium & Lowland	30-40
6	Malinja*	1971	140-145	120-130	MS	Medium & Lowland	30-40
7	Pankaj*	1971	150-155	110-120	LB	Lowland	50-60
8	Jagannath*	1971	160-165$	90-100	MS	Lowland	40-50
9	Deepa*	1972	130-135	90-100	LS	Medium land	40-50
10	Archana*	1972	130-135	90-100	LS	Medium land	40-50
11	Sita	1972	130-135	90-100	LS	Medium land	40-50
12	Panidhan I*	1972	145-150	90-100	MS	Rainfed lowland	30-35
13	Panidhan II*	1972	145-150	90-100	MS	Rainfed lowland	30-35
14	Saket-4 (CR 44-35)	1972	115-120	80-90	LS	Upland & Medium land	30-40
15	Narsingh*	1972	120-125	80-90	SB	Upland	30-40
16	Vishnu*	1972	115-120	80-90	SB	Upland	30-40
17	Rajendra Dahan 201*	1979	130-135	90-100	MS	Medium land	40-50
18	Rajendra Dahan 202*	1979	120-125	90-100	LS	Medium land	40-50
19	Jayshri*	1981	140-145	120-130	MS	Medium & Lowland	35-45
20	Sugandha (scented)	1983	155-160	130-140	MS	Medium & Lowland	25-35
21	Janki	1983	165-170	130-150	LB	Deepwater (50-100cm)	15-25
22	IR 36	1983	120-125	90-100	LS	Medium land	40-50
23	Sujata	1984	130-135	90-100	LB	Medium land	40-50
24	Radha	1984	150-155	110-120	MS	Lowland	50-60
25	Kanak	1987	135-140	95-105	LB	Medium land	50-60
26	Pusa Basmati-1	1994	130-135	90-100	LS	Medium land	30-40
27	Shakuntla	1995	140-145	120-130	LS	Rainfed lowland	35-45
28	Rajendra Mahsuri-1	2003	145-150	100-110	MS	Shallow lowland	50-60
29	Rajendra Sweta	2004	135-140	90-100	MS	Medium land	40-50

*-Out of cultivation $-Photoperiod sensitive

Rice Research Station, Moncompu, Kerala Agricultural University, Kerala

Established as "Paddy Breeding Station" in 1940, this Research Station under Kerala Agricultural University has the main mandate to breed varieties suitable for Kuttanad, to address the problems associated with the crop management and to transfer the technologies developed by conducting training programmes for the extension personnel.

Significant Achievements

The station has developed and released twenty high yielding rice varieties, the special features of which are given in table. The rice varieties developed by this station, besides being high yielding, possess resistance to specific biotic/abiotic stress situations experienced in Kuttanad. More than 70% of the rice area in Kuttanad is now covered by Uma (MO16). The varieties are also adapted to other rice cultivating tracts of Kerala. About 40% of the rice area in Kerala is covered by Moncompu rice varieties especially Uma. The Moncompu rice varieties MO4, MO7 and MO17 are being cultivated in other states like Karnataka and Goa.

This station also has a collection of the local rice germplasm in the field gene bank, which is used in identification of donors and developing new varieties.

Variety	Yield (t/ha)	Special features
MO4 to MO11 (Bhadra, Asha, Pavizham. Karthika, Aruna, Makom, Remya, Kanakom)	5.0-6.0	BPH Resistance
MO12 (Renjini)	5.0-6.0	Blast Resistance
MO13, MO14, MO16 (Pavithra, Panchami and Uma)	5.5-6.5	Gall midge resistance
MO16, MO17 (Uma, Revathy)	5.5- 6.5	Dormancy
MO18, MO19 (Karishma, Krishnanjana)	4.0- 4.5	Tolerant to adverse soil conditions like iron toxicity
MO20 (Gouri)	5.0-5.5	Resistance to sheath blight

RESEARCH NOTES

Marker aided improvement of parental lines of Pusa RH 10 for resistance to bacterial leaf blight

Basavaraj S.H[1]., Singh V.K[1]., Singh Atul[1], Singh Devinder[1], Nagarajan M[2], Mohapatra T[3]., Prabhu K.V[1] and Singh A.K[1]*. [1]Division of Genetics, IARI, New Delhi, [2]RBGRC Aduthurai, [3]NRCPB, New Delhi.

Pusa 6B and Pusa Rice Restorer78 (PRR 78), the maintainer and restorer parents, respectively of the first superfine grain aromatic rice hybrid, Pusa Rice Hybrid 10 (PRH 10), were improved through marker assisted transfer of two bacterial blight resistance genes *xa13* and *Xa21,* sourced from Pusa1460 (Improved Pusa Basmati1). The breeding strategy involved marker aided foreground selection for genes *xa13* and *Xa21* using a CAPS marker RG136 and a STS marker pTA248, respectively and background selection using 46 and 43 STMS markers polymorphic between Pusa 6B & Pusa1460 and PRR 78 & Pusa 1460, respectively. Background selection was coupled with phenotypic selection for agronomic, grain and cooking quality traits. Finally, the progenies were artificially challenged with most virulent 'Kaul' isolate of Xoo. In BC_1F_1, a single plant positive for both the genes and showing maximum recovery of recurrent parent genome based on background analysis, was selected for generating BC_2F_1 seeds. BC_2F_1 plants were further subjected to foreground and background selection and a single selected BC_2F_1 plant was selfed to produce BC_2F_2 seeds in both crosses. In the BC_2F_2, plants carrying genes *xa13* and *Xa21* in homozygous condition were identified using the linked markers.

Improved versions of PRR 78 showing resistance to BB (top) and their field view at maturity (bottom)

The extent of recurrent parent genome in the 9 BC_2F_2 plants homozygous for *xa13* and *Xa21* of Pusa 6B backcross series, designated with prefix Pusa 1605, ranged from 92.3% to 95.6%. The 4 BC_2F_1 plants of PRR78 backcross series, designated with prefix Pusa 1601, showed recurrent parent genome recovery ranging from 89.5% to 91.5%. Since, PRR 78 is the restorer line and the donor parent P1460 is a maintainer line, the presence of fertility restorer gene (*Rf1*) in the BC_1F_1 plants of PRR 78/P 1460//PRR 78 was identified using a *Rf1* gene linked STMS marker RM6100.

The BC_2F_5 and BC_2F_4 families of Pusa 1605 and Pusa 1601 series, respectively were highly resistant to the BB disease on artificial inoculation with the most virulent Kaul isolate of Xoo.

The basmati quality traits and agronomic traits of majority of the progenies in both the backcross series were similar to the respective recurrent parents. However, Pusa1605-05-38-32-31-4-1-1, Pusa1605-05-38-32-31-4-1-2, Pusa 1605-05-38-32-31-4-2-2, Pusa1605-05-38-32-117-2-1-6 and Pusa 1605-05-38-32-31-4-1-1, showed improvement in spikelet fertility and aroma and yield superiority. In the Pusa 1601 series, Pusa1601-05-46-22-25-5-1-1 and Pusa1601-05-46-22-25-88-5-3 showed superiority in KLAC while Pusa1601-05-46-22-2-88-5-2 showed yield superiority.

Many lines in both the crosses matured earlier than the recurrent parents, which will be useful in synchronization of flowering in hybrid seed production, as the original Pusa 6A is 5-10 days late compared to male parent PRR 78, posing problems of synchronization. Improved Pusa 6B and PRR 78 lines with genes *xa13* and *Xa21* have been intercrossed to identify the combinations as good as or better than Pusa RH 10, the selected Pusa 6B derivatives are under conversion for development of CMS with resistance to BB.

High yielding rice lines from elite x wild crosses

N Sarla, BP Mallikarjuna Swamy, T Sudhakar, A Prasad Babu, K Kaladhar, C Surendhar Reddy, G Ashok Reddy, MS Ramesha, N Shobha Rani and BC Viraktamath, DRR, Hyderabad.

As part of the program on mapping yield-enhancing QTLs from wild species, many introgression lines (ILs) have been developed that can be used in hybrid and varietal improvement programs. One accession of *O. rufipogon* was used for improving the restorer line KMR3 and two accessions of *O. nivara* for the improvement of Swarna. Thirty selected introgression lines each of KMR3 and Swarna were evaluated in DRR field on a small scale during *kharif* 2008. The 60 ILs were grown in 5 rows each with 24 plants per row, in 2 replications with 6 check varieties. Data on yield/plot was taken from the middle 66 plants from the middle 3 rows and on 7 yield related traits from 5 plants in the middle row.

KMR3-*O.rufipogon* - KMR3, Annada and IR-64 were grown as checks. In the 30 ILs (back cross derivatives of the cross RPBio4919) plant height ranged from 104cm in IL409 to 163cm in IL194, number of productive tillers/plant from 14 in IL467 to 18 in IL117, panicle length from 21cm in IL242 to 25.6cm in IL387, panicle weight ranged from 2.9g in IL473 to 4.8g in IL50, yield/plant from 36.9g in IL491 to 89.5g in IL50 and yield/plot from 718g in IL410 to 1100g in IL50. Ten lines- IL50, IL194, IL495, IL117, IL106, IL458, IL349, IL467, IL215 and IL198 out yielded the 3 checks (Table). The yield advantage over KMR3 ranged from 4% to 45%. In addition, compared to KMR3, IL194 and IL501 have darker brown husk (Fig. 1), IL215 and

Fig. 1: IL of KMR3 x *O. rufipogon*

IL409 are shorter, IL106 has bolder grains and IL463, IL501, IL194, IL50, IL198 and IL458 matured 10 days earlier. Yield advantage over the best check Annada ranged from 1 to 27%.

Swarna-*O.nivara* - Swarna, Jaya and Salivahana were used as checks. Nine out of 30 ILs out yielded Swarna by 15% and one by 4%. They also matured upto 10 days earlier (Table). The best two introgression lines gave 42% and 33% yield advantage over Swarna despite maturing 15 days and 11 days earlier. The IL 166S showed 28% yield increase and also had medium slender grains compared to medium bold grains of Swarna. The IL 3-1S gave a yield advantage of 24% and matured 17 days earlier than Swarna. Such lines can be grown in areas where shorter duration lines are desirable. IL 230S with 18% yield advantage was derived from BC_2F_3 lines with high iron and zinc in the grains. In the ILs 164S, 70S, 230S, 13K, 250K the yield advantage over Swarna was more than 15% and they matured 10 days earlier. IL 14S was included in the evaluation as it had medium slender grains (Fig. 2). These 20 high yielding introgression lines of KMR3 and Swarna are being further evaluated.

Fig. 2: Swarna introgression line IL-166 (right) with more spikelets than Swarna (left)

High yielding introgression lines

KMR3 ILs/Checks	Plant height (cm)	Days to maturity	Plot yield (g)	% yield increase over KMR3	% yield increase over Annada
RPBio4919-50	151	126	1101	45.6	27.3
RPBio4919-194	163	124	982	29.9	13.5
RPBio4919-495	141	132	967	27.9	11.8
RPBio4919-117	141	127	946	25.1	9.4
RPBio4919-106	137	130	935	23.7	8.1
RPBio4919- 458	143	125	924	22.2	6.8
KMR3	149	135	756	0	-
Annada	94	122	865	11.4	-
IR64	99	124	842	14.4	-
Swarna ILs/Checks				**Over Swarna**	**Over Salivahana**
RPBio4918-7K	101	130	794	42	8
RPBio4918-248S	96	134	744	33	2
RPBio4918-166S	89	132	719	28	-
RPBio4918-3-1S	100	135	706	26	-
RPBio4918-164S	96	128	694	24	-
RPBio4918-70S	83	131	660	18	-
Swarna	96	145	560	-	-
Jaya	87	130	619	-	-
Salivahana	109	138	735	-	-

A New Functional co-dominant PCR based marker for aroma trait in Basmati and Non-Basmati Aromatic Rices

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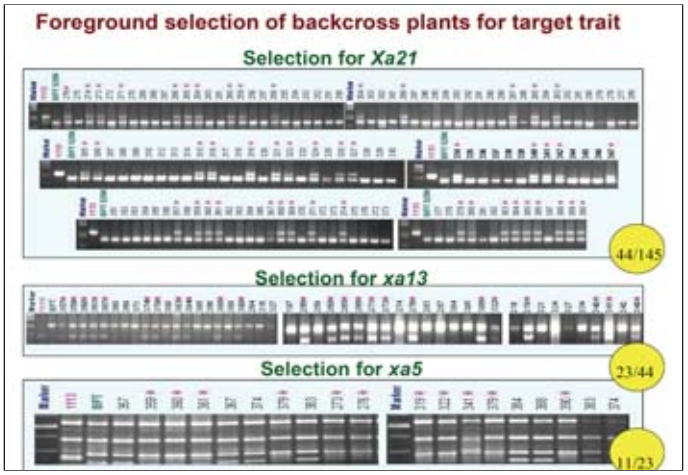
Aromatic rices are specialty rices sold at a premium price in local and international markets because of their superior grain quality characteristics and pleasant aroma. Basmati rices as such constitute a unique group *par-excellence* in quality features with distinct aroma. The unique aroma in these rices is considered to play a major role in its marketability/consumer acceptability. More than 100 volatile compounds have been reported in the rice grain, of which, 2-acetyl-1-pyrroline (2AP) is regarded as the most important flavor component with a lower odour threshold which gives both Basmati and Jasmine rices, their distinct aroma. Accumulation of 2AP and subsequent aroma development in rice has been reported to be due to the deletion of a 8-bp region in the exon 7 of *badh2* gene located on Chromosome 8S.

After cloning of the gene, multiplex markers targeting the functional insertion/deletion (InDel) polymorphism were earlier developed (Bradbury et al. 2005; Plant Biotechnology Journal, 3: 363-370) for genotyping aroma trait, but the use of this multiplex marker system is complex and tedious not only due to the need to use more than one primer pair, but also due to the weak amplification of one of the products, inconsistencies due to the competitive nature of the binding of primers to the genomic DNA templates of respective alleles and chances of non-specific amplification when there is even a slight difference in the relative primer concentration. An ideal functional marker for aroma trait should be as simple as possible to assay the given genotype, based on which the phenotype can be accurately predicted. Towards this effort, we have developed a simple PCR based co-dominant marker which directly assays the 8-bp deletion in the exon 7 of *badh2* gene and clearly distinguishes aromatic rice genotypes from non-aromatic ones. The marker, named BADEX7-5 amplifies 95-bp and 103-bp fragments in fragrant and non-fragrant genotypes respectively, which can be easily resolved in a simple 3% agarose gel stained with ethidium bromide.

In order to validate the marker, a diverse collection of 13 notified Basmati rices (six traditional and seven evolved), 4 long to medium slender (MS) grain aromatic landraces, 28 short grain aromatic landraces and 13 non-aromatic varieties were screened. It was observed to be highly efficient in discriminating all fragrant and non-fragrant genotypes and



showed perfect co-segregation with the trait of aroma when validated in a F2 mapping population derived from the cross Basmati370/Samba Mahsuri, which is segregating for the trait of aroma. BADEX7-5 marker is an improvement over the multiplex marker system and has the advantages of being very simple, less expensive and reproducible. We recommend this co-dominant, functional marker BADEX7-5 for large scale and routine aroma genotyping/marker-assisted selection (MAS) using simple agarose gel systems.

Brown Planthopper Outbreak on rice in Delhi, Haryana and West Uttar Pradesh

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Unprecedented outbreak of brown planthopper (BPH), *Nilaparvata lugens* on rice was witnessed in Delhi, Haryana and West Uttar Pradesh during the months of September-October 2008. The nymphs and adults in several thousands were observed on rice plants. These insects in both nymphal and adult stages normally suck plant sap at the base of plants and leaf sheaths. However, their population was so high that these were also seen feeding on leaves and panicles as well. The healthy rice crop was greatly damaged within a span of 3-4 days especially in the grain filling stage leading to total loss of rice production. A survey of rice fields around Delhi revealed about 40-70% hopper burn damage. Being attractive to light, these even invaded homes and offices nearby during night; thus became a news-item in some of the leading newspapers too.

The BPH completes one generation in less than a month and have a high reproductive potential to multiply ten to hundred fold in each generation. Adult hoppers are brownish black measuring 3.5-4.5 mm in length. Since these insects generally remain confined to plant stems and leaf sheaths, their presence goes undetected. The dry brown spots in the lush green paddy

Planthopper damaged crop

field, known as hopper burn, are often the first visible symptoms, which spread very fast if not contained. Under severe infestation, circular patches of hopper burn are evident in the field. Severely affected plants do not bear any grains. It has been reported that 400 newly hatched nymphs infesting plants could cause complete drying in 3 to 15 days at 25 to 50 days after transplanting (DAT), respectively. Plants nearing maturity also develop hopper burn if infested with about 400-500 nymphs and adults.

This insect occurs in two distinct forms viz., (i) the macropterous (long winged) and (ii) the brachypterous (short winged). The macropterous forms are responsible for spread of the pest over long distances, while brachypterous forms spread from field to field through irrigation and drain water. Migration of macropterous forms over long distances over sea as well as land resulting in sudden appearance in the rice fields has been reported.

Regular intermittent rains right from summer months until September in 2008 led to high humidity and optimal temperature, which resulted in rapid multiplication of rice planthoppers. Farmers reported failure of some insecticides especially neonicotinoids against these pests even at double the recommended concentration. Toxicological studies at Division of Entomology, IARI, New Delhi, showed some tolerance of planthopper population to neonicotinoids like imidacloprid and thiamethoxam. Therefore, very high population of plant hoppers coupled with tolerance to noenicotinoids/failure of insecticides especially contact ones to reach the target due to dense crop canopy and death of natural enemies due to indiscriminate use of insecticides, were responsible for heavy production losses in rice.

Regular monitoring and cultural methods are very important for planthopper management. Provision of alleyways to ensure proper aeration in the field and to facilitate pesticide application, alternate wetting and drying, and optimum and balanced use of fertilizers and manures can play an important in their management. Besides, natural enemies of planthoppers such as spiders, predatory bugs and beetles also need to be conserved against harmful effects of broad spectrum pesticides. Safer formulation of insecticides such granules may be preferred as these pose less hazard to natural enemies. Pesticide sprays especially with contact insecticides should be aimed at basal portion of plants. However, this becomes difficult due to dense crop canopy during advanced crop growth stages and it also results in lower efficacy of insecticides. It is high time that this outbreak should strengthen the system of forecasting and monitoring of insect infestation at regional level.

New record of *Popillia lucida* Newman on Paddy in Himachal Pradesh (INDIA)

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Rice is cultivated on an area of 80 thousand hectares during *kharif* season in Himachal Pradesh under diverse agro-climatic conditions from foot hills (350m MSL) to high hills (2300m MSL) in rainfed and irrigated ecosystems. The crop was found to be damaged by a Scarabaeid, *Popillia lucida* Newman (Scarabaeidae: Coleoptera). This insect-pest which invaded the crop at flowering stage was got identified by Dr. V. V. Ramamurthi of Indian Agricultural Research Institute, New Delhi.

The beetle was found to feed on the spikelets at the flowering stage of the crop. The adult beetle is 1.3 – 1.5 mm long, somewhat hemispherical, shiny, and brightly coloured with metallic green thorax and reddish very prominent abdomen. They were characterised by unequal claws on hind legs and a sclerotised labrum (Fig.1). The beetles were scattered and damage was noticed in patches. The beetles open the spikelets and feed on the milky grains leading to the total chaffiness (Fig. 2). The beetle was found to be active in both the dry and wet seasons, coinciding with the flowering stage of the crop. Peak activity was observed from the last week of August to second week of September, depending upon the existence of a suitable crop stage. The incidence of this beetle has been recorded from rice fields in Kangra, Mandi, Una and Sirmour districts of Himachal Pradesh. There was no report of this rice pest elsewhere in the world.

Experiments were conducted in the farmer's field at village Ansui of Kangra district during Kharif 2007 and 2008 to assess the damage caused by this insect. The rice cultivar HPR-1068 and Hybrid (HRI-152) was planted in 4m x 4m plots during Kharif seasons 2007 & 2008 and replicated 4 times

under protected and unprotected sets. The Chaffer beetle population were recorded at panicle initiation and full panicle emergence stage. The losses in yield (14.95- 24.84 %); grain number/panicle (26.69-35.65%) and grain weight/panicle (14.95- 37.57 %) were recorded during 2007 and 2008 (Table).

Fig.1. *Popillia lucida* Newman

Fig.2. Damage by *Popillia lucida* Newman

Assessment of yield losses due to *Popillia lucida* Newman

Year	Chaffer beetles per 10 hills		Yield (q/ha)		% yield loss	Grain number/ panicle		% loss in grain number/ panicle	Grain weight/panicle (g)		% grain weight loss/ panicle
	P	U	P	U	P	U	P	U	P	U	
2007	2.07	6.64	16.10	12.10	24.84	251	184	26.69	5.60	3.49	37.57
2008	1.00	8.66	66.87	56.87	14.95	244	157	35.65	5.34	3.41	14.95

P: protected and U: unprotected

Water Management in Rice: Need for Change

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The water consumption in rice crop is high as it is grown under submerged irrigated low land condition; soil is puddled and after the transplanting of rice seedlings the field is kept flooded with 2.5 cm of water until 10 days before harvest. Water required to produce one kg of rice is two to three times more times more than the water required for producing one kg of other cereals (wheat or maize). The State of Tamil Nadu in India has 7 per cent of country's population, 4 % of the land area and 3 % of water wealth. The per capita availability of water in Tamil nadu is 800 m^3 yr^{-1} compared to 3200 m^3 yr^{-1} at all India level. The per capita water availability is estimated to decline by 50 per cent in the next 15 years (2025), simultaneously increasing the demand for water in agriculture to two folds. In this context, it is necessary to frame appropriate strategies to bridge the growing gap between supply and demand of water for rice cultivation.

Water requirement of rice: Rice is water loving plant

The short duration rice crop requires about 1240 mm of water. It's per day requirement will be 6-10 mm, 180-380 mm for evaporation, 200-250 mm for transpiration, 200-700 mm for percolation in toto. The nursery requires 3 per cent (40 mm); field preparation 16 per cent (200 mm) and for entire crop growth in the main field requires 81 per cent (1000 mm) of water.

Water management strategies in Rice

- Puddling and levelling minimizes the total water requirement

- Plough with tractor drawn cage wheel to reduce percolation losses and to save water requirement up to 20 per cent.
- Maintain 2.5 cm of water over the puddle field and allow the green manure to decompose for a minimum of 7 days in the case of less fibrous plants like sunnhemp and 15 days for more fibrous green manure plants like Kolinchi (*Tephrosia purpurea*).
- At the time of transplanting, a shallow depth of 2 cm of water is adequate since high depth of water will lead to deep planting resulting in reduction of tillering.
- Maintain 2 cm of water up to seven days of transplanting.
- After the establishment stage, cyclic submergence of water is the best practice for rice crop. This cyclic 2.5 cm submergence has to be continued throughout the crop period, till flowering stage.
- During crop growth stages, the irrigation interval should not exceed the stipulated time so as to cause the depletion of moisture below the saturation level.
- In booting and maturity stages continuous inundation of 5 cm and above leads to advancement in root decay and leaf senescence, delay in heading and reduction in the number of filled grains per panicle with poor harvest index.
- Provide adequate drainage facilities to drain excess water or strictly follow irrigation schedule of one day after disappearance of ponded water.
- The last irrigation should be 10-15 days ahead of harvest.

Integrated water management in rice during water demand

- Summer ploughing reduces 20 to 30 per cent water requirement of *kharif* rice
- Good puddling and perfect leveling the fields properly enhances water use efficiency
- Forming separate irrigation and drainage channels for each field
- Reducing the width of the irrigation channel and preventing water seepage from the channels and bunds
- Forming small plot size (50-60 cents) with small bunds
- Plugging rodent holes
- Seed treatment with seed hardening treatments
- Formation of earthern hand bund (*Kaivarappu* or *Kattuthalai*) of 15-20 cm at 25 to 30 cm inside the existing field bunds
- Rotational water supply with available water
- In situ water conservation by impounding more water in the field during rainy season

Experimental evidence

A field experiment was conducted at Department of Rice, TamilNadu Agricultural University for three consecutive seasons with CORH 3 Rice hybrid to analyse the amount of water saved through water saving techniques. Water management systems followed where as follows,

Management Practices

Conventional System: Cyclic submergence of water up to 2.5 cm height through out the cropping period

System of Rice Intensification: Irrigation on appearance of hairline cracks up to PI. 1-2 cm after PI till 15 days before harvest

Intermittent Irrigation : The periodicity of cyclic drainage cum re-watering will continue until maturity with 7d-7d alternate dry & wet conditions from 15 DAP.

The study revealed that SRI had water productivity 0.51 kg m^3 compared to 0.34 kg m^3 in conventional system. There was 25 per cent water saving in SRI and 39 per cent in intermittent irrigation in comparison to conventional system which consumed about 16125 m^3 ha^{-1}. The numbers of irrigation given were 32 in conventional system, 26 in SRI and 20 in intermittent irrigation. Higher LAI (5.4) recorded in SRI compared to conventional and intermittent irrigation system. Also less specific leaf area (more leaf thickness) produced in SRI system followed by intermittent irrigation system and conventional. SRI had more relative leaf water content compared to intermittent irrigation system. Number of tillers produced were more in SRI (38) compared to intermittent irrigation (20) and conventional (16) system. Higher grain yield was recorded in SRI system (6200 kg ha^{-1}) over conventional system (5600 kg ha^{-1}) and intermittent irrigation system (4500 kg ha^{-1}) in CORH 3 rice hybrid.

Conventional System

System of Rice Intensification

Intermittent Irrigation

Water saving Studies in CORH 3 hybrid rice under different water management systems

Parameters	Conventional system	System of Rice Intensification	Intermittent Irrigation
Plant height (cm) at harvest	70.00	68.00	66.00
Leaf Area Index at flowering	5.00	5.40	4.70
SLA (cm^2/g) at flowering	287.00	254.00	271.00
RWC (%) at flowering	89.00	85.00	83.00
Number of tillers per plant	16.00	38.00	20.00
Number of panicles m^2	450.00	476.00	443.00
Number of grains $plant^{-1}$	210.00	243.00	224.00
SPAD value at flowering	41.40	42.80	40.10
Per Panicle weight (g)	2.73.00	2.86	2.63
Grain Yield (kg ha^{-1})	5600.00	6200.00	4500.00
Straw yield (kg ha^{-1})	7250.00	7500.00	5800.00
Biomass (kg ha^{-1})	13950.00	14500.00	11150.00
Number of Irrigations	32.00	26.00	20.00
Total water used (m^3 ha^{-1})	16125.00	12090.00	9680.00
Water productivity (kg m^3)	0.34	0.51	0.46

Forthcoming Events

- USAID workshop to initiate the planning process for the activities on rice breeding - April 23rd-24th 2009 at New Delhi
- Launch of Cereal Systems Initiative for South Asia (CSISA) project funded by the Bill and Melinda gates foundation - April 29th 2009 at New Delhi
- An interactive policy dialogue on SRI - May 4th, 2009 at Hyderabad
- 44th Annual Rice Workshop - 9th -12th May 2009 at Hyderabad

DIRECTOR'S MESSAGE

A good beginning.... but a long way to go ...

I am happy to note that this year started on a good note for us with signing of ICAR-IRRI work plan agreement which will strengthen our research programs and ensures continued access to global resources. The last quarter was scientifically rewarding with the launch of several new research projects and fruitful deliberations during the RAC and IMC meetings. Besides research, our staff also participated in ICAR South Zone sports meet and won prizes. I am sure all our co-operators are gearing up for Annual Rice Workshop. Once again, I welcome you all for this meeting. I take this opportunity to appreciate the newsletter editorial team for bringing new changes in the design and coverage by including research notes reflecting emerging trends in rice research. I hope many more useful research notes are contributed from you all for the forthcoming issues. I welcome your suggestions to serve you still better.

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