IIRR
ICAR-Indian Institute of Rice Research
NEWSLETTER
Volume: 15 Number: 2&3 RICE IS LIFE April - September 2017

LII Annual Rice Research Group Meeting, Jorhat

Fifty second edition of Annual Rice Research Group Meeting of All India Coordinated Rice Improvement Project (AICRIP) was held at Assam Agricultural University (AAU), Jorhat from 8-11 April, 2017. More than 376 delegates from all over the country participated in the meeting. Sri. Atul Bora, Hon'ble Minister of Agriculture, Assam was the Chief Guest of Inaugural Function. He appreciated the initiative of ICAR and efforts of AAU to hold the group meeting in Assam for the first time. He appealed to the scientific community to develop technologies to make rice farming more productive and remunerative. Welcoming the gathering, Dr. K. M. Bujarbaruah, Hon'ble Vice Chancellor, AAU stressed up on the need for convergence and collaboration among the various disciplines for developing problem solving and demand driven technologies. He urged to identify and use novel genes/alleles from rice germplasm of the Northeast India. Dr. V. Ravindra Babu, Director, ICAR-IIRR informed the house about the varieties released through State Variety Release Committee (SVRC) and Central Variety Release Committee (CVRC) and the flagship programs of the institute to address multitude of issues in rice production. Dr. I. S. Solanki, Additional Director General, (FFC), ICAR complimented the contribution of AICRIP in achieving the record food grain production and called upon the researchers to focus on productivity enhancing technologies including indica varieties with redesigned plant types.

A total of 45 varietal trials, four hybrid trials, one screening nursery and five INGER nurseries were conducted in all the seven zones. Across various ecosystems, 27 promising entries were identified. Breeder's seed production was taken up in 43 centres involving 284 varieties and eight hybrids with a total production of 87.64 tonnes. A set of 114 hybrid entries were tested and 10 promising hybrids were identified. Ten hybrids by CVRC and five hybrids by SVRC were released during 2016.

In agronomy experiments 11 genotypes responded to 50 per cent RDN. In cultural management trials, mechanical transplanting followed in SRI cultivation recorded highest grain yield. In weed management trials the efficient dose of rinskor, a new herbicide was worked out to be 31.25 g a.i. ha^{-1}. Keeping in view the water scarcity direct seeding is advocated. Improvement in grain yield was reported with gypsum amendment along with recommended NPK over control. Drought, heat and low light intensity tolerant entries were identified in physiology experiments. In plant protection experiments 58 promising entries were identified from evaluation of 1633 entries against different pests. For blast 1288 resistant lines were identified in uniform blast nurseries. To disseminate new technologies among the farmers 549 technologies were evaluated in 550 hectare area and 50 promising technologies were demonstrated under Front Line Demonstration program. The Varietal Identification Committee under the chairmanship of Dr. J. S. Sandhu, DDG (CS), ICAR identified 23 varieties and hybrids for release in respective zones and states.

IN THIS ISSUE

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RESEARCH HIGHLIGHTS

Kapri: A Rice landrace from Chhattisgarh with superior cooking quality

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The quality characteristics are a priority issue in rice breeding. *Kapri*, a landrace collected from Sitapur village (Bagicha), Jashpur District of Chhattisgarh State exhibited promising quality (cooking) characters. The elongation ratio is double the length-wise elongation. This is the first report on the quality characteristics of any landrace of Chhattisgarh region. The length wise elongation is governed by one QTL, qER5.1 on chromosome5 in Basmati 370. The QTL study of *Kapri* for elongation is under investigation. The Comparison of quality parameters of Kapri and Basmati 370 is presented in Table 1.

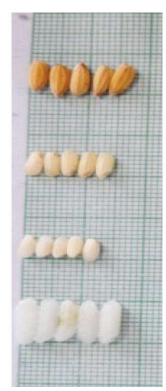
Table 1: Quality characters of *Kapri* and Basmati 370

S.No.	Characters	Kapri	Basmati 370
1.	Decorticated Grain length (mm)	5.8	6.49
2.	Decorticated Grain width (mm)	1.8	1.82
3.	Decorticated Grain length /width ratio	3.2	3.57
4.	Kernel length (mm)	5.2	6.61
5.	Kernel width (mm)	1.6	1.54
6.	Kernel length/width ratio	3.2	4.29
7.	Kernel length after cooking (mm)	11.4	13.21
8.	Kernel width after cooking (mm)	4.2	3.57
9.	Kernel length/width ratio after cooking	2.7	3.71
10.	Elongation ratio	2.2	2.33
11.	Hulling percentage	76.6	69.5
12.	Milling percentage	60.7	63.83
13.	Head rice recovery percentage	54.5	47.3
14.	Alkali spreading value	7	5
15.	Gel consistency (mm)	41	44
16.	Amylose content percentage	20.5	21.03

Paddy

Hulled rice Paddy of Kapri

Milled rice Paddy of Kapri



Elongated

IIRR Newsletter

Performance of nitrogen use efficient varieties across locations

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With an emphasis on low input and environmentally sustainable agriculture, a trial aimed at Nitrogen Use Efficiency was constituted by ICAR-IIRR during the *kharif* 2016. Efficient cultures identified by six AICRIP centres (Table 1) were tested at four locations, Bapatla (BPT), Chinsurah (CHN), Dharwad (DHR) and Gangavathi (GNV). The treatments included two main treatments: N at 100% recommended dose and N at 50% recommended dose; and fifteen varieties as sub treatments. At Dharwad 75% and 100% N were adopted. The recommended N (RD-N) was imposed at four centres (BPT, CHN, DHR and GNG @ 160, 80, 75 and 150 Kg/ha, respectively).

Grain yield data indicated that there was no significant difference between N levels at two centres (BPT and GNV) (Fig. 1). This could be attributed to the higher recommended N at these centres so that the reduced N dose could not reflect in significant decrease in grain yield. Whereas, at CHN and DHR, 100% RD-N recorded significantly higher grain yield by 20 and 34%, respectively, over reduced N level.

With regard to genotypes, there was significant variation in grain yield among the genotypes ranging from 3.5-6.8, 2.6-4.6, 1.9-7.3 and 2.7-8.7 tonnes/ha at BPT, CHN, DHR and GNG, respectively. The genotype SKAU-483 recorded lowest yield at BPT and GNG (2.7-3.5 tonnes/ha) while BPT varieties recorded lowest yield at CHN and DHR (1.9-2.6 tonnes/ha). The highest yield was recorded by MO 22-Shreyas at BPT (6.8 tonnes/ha) and CHN (4.6 tonnes/ha); MGD-101 at DHR (7.3 tonnes/ha) and RNUE-10 at GNG (8.7 tonnes/ha). The other varieties in order are: MGD-1605, BPT-NUE-1, BPT-NUE-2 which were on par to MO 22-Shreyas at BPT; RNUE-10, Varadhan and IR-64 which are on par to MO 22-Shreyas at CHN; MO 21-Pratyasa, MO 22-Shreyas and MGD-1605 at DHR; and MGD-1605, BPT-NUE-3, GV-NUE-1and IR-64 at GNG. Based on the grain yield performance, top five genotypes at each centre are listed in Table 2. The variety, MGD-1605 can be considered best as it occupied top 5 list of all locations followed by MO 22-Shreyas and RNUE-10 at 3 locations, followed by GV-NUE-1 at 2 locations.

Table 1: Particulars of the genotypes tested

Genotype	Centre	Genotype	Centre
MO 21-Pratyasa	Moncompu	BPT-NUE-2	Bapatla
MO 22-Shreyas	Moncompu	BPT-NUE-3	Bapatla
SR-3	Kashmir	GV-NUE-1	Gangavathi
SK AU-408	Kashmir	R NUE-6	ICAR-IIRR
SKAU-483	Kashmir	RNUE-10	ICAR-IIRR
NVR-5	Dharwad	VARADHAN	ICAR-IIRR
MGD-1605	Dharwad	IR-64	Check
BPT-NUE-1	Bapatla		

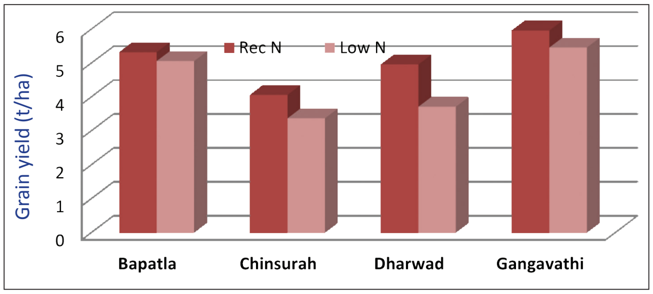

Fig.1: Grain yield at differen centres

Table 2: Top five NUE genotypes at different locations

Bapatla		Chinsurah		Dharwad		Gangavati	
Variety	Yield*	Variety	Yield*	Variety	Yield*	Variety	Yield*
MO 22-Shreyas	6.84	MO 22-Shreyas	4.59	MGD -101	7.27	RNUE-10	8.74
MGD-1605	6.64	Varadhan	4.45	MO 21-Pratyasa	6.17	MGD-1605	8.01
BPT-NUE-1	6.76	RNUE-10	4.35	MO 22-Shreyas	5.47	BPT-NUE-3	7.44
BPT-NUE-2	6.35	IR 64	4.33	MGD-1605	5.51	GV-NUE-1	7.64
GV-NUE-1	5.66	MGD-1605	4.17	RNUE-10	4.57	IR 64	7.37

*****tonnes/ha

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Identification of resistant sources to rice brown planthopper from ENRRD germplasm

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In order to identify the sources of resistance to brown planthopper (BPH), *Nilaparvata lugens* (Stal) (Homoptera: Delphacidae), 1200 ENRRD indigenous germplasm accessions were screened for their reaction to BPH. Screening was carried out by adopting mass screening technique under controlled greenhouse conditions as per the technique described by Kalode *et al.* (1975). First instar nymphs of BPH were released on 12-13 day old seedlings of the test entries by tapping heavily infested plants from oviposition cages on the screening trays, ensuring that each test seedling was infested with at least 6-8 nymphs. The screening trays with BPH nymphs were covered with mylar cages to prevent escape of the nymphs. The infested trays were monitored regularly for plant damage. When more than 90 per cent plants of the susceptible check, TN1 were killed, the test entries were scored for the damage reaction, based on 0-9 scale of International Standard Evaluation System (IRRI, 1988). Out of 1200 ENRRD accessions, 46 accessions exhibited damage score (DS) ranging from 0 to 5 and they were designated as highly resistant (0-1), resistant (1-3) and moderately resistant (3.1-5.0). Out of the 46 entries, 3 germplasm accessions viz., IC 343457, IC 300168 and IC 377051 were highly resistant with a damage score of 0 to 1; while, 24 accessions *viz.,* IC 319799, IC 301181, IC 343394, IC 449821, IC 343392, IC 341334, IC 300166, IC 464944, IC 300167, IC 461801, IC 319350, IC 343515, IC 497079, IC 577624, IC 545441, IC 377527, IC 554787, IC 321833, IC 252243 were resistant with a damage score of 1.1 to 3 and 19 accessions were moderately resistant with a damage score of 3.1 to 5.0.

Table 1: Reaction of germplasm accessions to BPH

S.No.	Accession no.	Score	Reaction	S.No.	Accession no.	Score	Reaction
1.	IC 343457	0.3	HR	24	IC 377423	2.8	R
2.	IC 300168	0.6	HR	25	IC 554787	2.8	R
3	IC 377051	0.9	HR	26	IC 321833	2.9	R
4	IC 319799	1.1	R	27	IC 252243	3.0	R
5	IC 343394	1.2	R	28	IC 461261	3.2	MR
6	IC 301181	1.3	R	29	IC 450072	4.0	MR
7	IC 449821	1.3	R	30	IC 413638	4.1	MR
8	IC 343392	1.3	R	31	IC 300914	4.2	MR
9	IC 464944	1.4	R	32	IC 377746	4.5	MR
10	IC 450041	1.4	R	33	IC 332672	4.6	MR
11	IC 341334	1.4	R	34	IC 145400	4.6	MR
12	IC 300166	1.6	R	35	IC 145402	4.7	MR
13	IC 377527	1.7	R	36	IC 300378	4.7	MR
14	IC 300167	1.8	R	37	IC 300991	4.8	MR
15	IC 319350	2.1	R	38	IC 300683	4.8	MR
16	IC 346927	2.1	R	39	IC 578362	4.9	MR
17	IC 343457	0.3	R	40	IC 450382	4.9	MR
18	IC 343515	2.2	R	41	IC 301172	5.0	MR
19	IC 300202	2.4	R	42	IC 300163	5.0	MR
20	IC 577624	2.5	R	43	IC 17037	5.0	MR
21	IC 545441	2.5	R	44	IC 145419	5.0	MR
22	IC 497079	2.7	R	45	IC 377055	5.0	MR
23	IC 461801	2.7	R	46	IC 578927	5.0	MR

Promising new elite rice cultures under adaptive minikit testing in Andhra Pradesh

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Andhra Pradesh Rice Research Institute and Regional Agricultural Research Station (APRRI & RARS), Maruteru identified seven promising rice cultures with high yield, non-lodging, low shattering, and tolerant biotic stresses. These elite rice cultures are under intensive testing in adaptive minikit trials at farmers' fields during 2016, 2017 to assess their suitability, potentiality in terms of yield, tolerance to various stresses, and cooking quality in the 13 districts of Andhra Pradesh. The characteristics of these varieties are given in the table. Results of *kharif* 2016 are encouraging with 5-12 % yield advantage over existing checks. MTU 1229 was identified as alternative variety to Swarna possess nutrient use efficiency alleles of nitrogen and phosphorous with non lodging trait. MTU 1226 is bold grain type having non lodging trait suitable to *kharif* season and parboiling. MTU 1224 a medium duration fine grain type is an alternative culture to sambamahsuri with two weeks seed dormancy and good cooking quality. Two cultures MTU 1187 and MTU 1210 are suitable for both the seasons, non lodging, tolerant to leaf blast with good cooking quality. Flood tolerant culture MTU 1184 is alternative to PLA 11000 with good grain quality and BPH tolerance and two weeks seed dormancy. MTU 1194 is high yielding, non lodging, long duration variety for irrigated ecosystem with two weeks of seed dormancy. These rice cultures are fast spreading among the farmers by virtue of their climate resilience and inherent traits like non lodging, low shattering, seed dormancy, suitability to labour saving technologies like, machine harvesting and direct seeding.

IET 24617: A potential high yielding Aromatic Short Grain pre-released culture

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In a breeding programme for improvement of aromatic short grain (ASG) rices, around 50 promising semi-dwarf advanced lines generated through pedigree selection were found to be promising in station yield trials. One of those lines designated as RP 4926-215-111-74-21-12 had high yield potential (4.6 to 5.0 t/ha) comparable to that of Shobini, the national check variety and the quality traits equal to the minimum required for market acceptability. It is a semi-dwarf, non-lodging, medium maturing and medium slender aromatic translucent grained culture originated from the cross Swarna x RAU 3041 (Figure 1a). This culture designated as IET No. 24617 was tested in ASG trials of AICRIP wherein, it showed yield superiority continuously for three years (2014-16). Initially it was evaluated in IVT-ASG during 2014 at 18 locations. In five states it recorded yield advantage over the best check (Local check) in Uttar Pradesh (45% and 4431 Kg/ha), Bihar (18%, 5714 Kg/ha) and Maharashtra (24% and 4686 Kg/ha); in Gujarat (52% and 6004 Kg/ha) over the best check Kalanamak and in Chhattisgarh (7% and 4379 Kg/ha) over the best check Badshahbhog. It was promoted to AVT-1-ASG and evaluated in 18 locations during 2015. It excelled over the best check-Shobini with 31% yield superiority in Tripura. Subsequently it was tested in 20 locations during 2016, the third year of testing. Again this culture performed well in three states namely, Maharashtra over the best check Sugandha Samba (13.3% & 4988 Kg/ha); Shobini in Gujarat (5.9% & 4293 Kg/ha) and in Tamil Nadu (14 % and 4704 Kg/ha).

It possesses desirable grain quality features such as translucent medium slender grains, high head rice recovery (HRR) (66.1%), no chalkiness, intermediate alkali spreading value (4.0), intermediate amylose content (22.4%) along with moderate aroma (Table 1, Fig 1b & 1c). It recorded good kernel elongation (9.4 mm) with 190% lengthwise elongation upon cooking (Fig 1d). Higher lengthwise elongation of cooked kernel is generally preferred by consumers and traders. It is superior to Dubraj, the quality check variety by having high HRR (66.1%), semi-dwarf plant type (100-105 cm), medium maturity duration (130-135 days), photoinsensitivity and mean yield potential of 4.6 to 5 t/ha. It is moderately resistant to leaf and neck blast, brown spot, sheath rot diseases and to leaf folder and stem borer among pests. Thus there exists a good scope for exploiting its yield potential under aromatic short grain rice category.

Table 1: Grain quality parameters of IET 24617

Name	HRR (%)	KL (mm)	KLAC (mm)	ASV	AC (%)	GC
IET 24617	66.1	4.95	9.4	4.0	22.4	22
Shobini (NC)	51.3	5.26	9.1	5.0	23.3	32
Dubraj (QC)	63	5.14	8.6	4	25	45

HRR: Head rice recovery, KL: Kernel length, KLAC: Kernel length after cooking, ASV: Alkali spreading value, AC: Amylose content, GC: Gel consistency NC: National check, QC: quality check

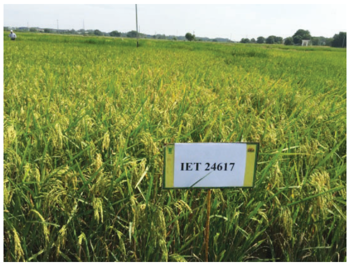

Figure 1a: Field view

Figure 1b: Paddy

Figure 1c: Medium slender grain type

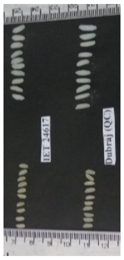

Figure 1d: Kernel length before and after cooking

Salicornia *brachiata* - Multipurpose seasonal herb of coastal saline soils

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Salicornia brachiata is a succulent halophyte belongs to the family Amaranthaceae and subfamily Salicornioideae. It occurs along the estuarine habitats of the tropical and temperate water of North America, Europe, Africa and south Asia. This halophyte species is prominent in South Asia and popularly known as Sea Asparagus. It is a salt tolerant and drought resistant plant, which grows in the transitional zone between terrestrial and mangroves. *S. brachiata* is a small annual herb which completes its life cycle in eight to nine months and has the potential in reclaiming coastal saline soils because of their tolerance to salt water. It is grown in coastal salt marshes and inland salty habitats like shores of salt lakes for the purpose of reclamation of the soils there. However, *S. brachiata* is a problem to paddy fields due to salt water intrusion. It is one of the most important plant materials for various applications in daily life. The plant as such is cooked and eaten or pickled for long term use; a good fodder for cattle, sheep and goat; used as raw material in paper and board factories. Seeds yield high quality edible oil which is made up of highly poly unsaturated fatty acids similar to safflower oil and also one of the potential plant for extraction of biofuels. The vegetable salts with low sodium obtained from waste biomass after removing the seeds for oil and used in traditional medicinal.

Around seven million ha of land area is affected with saline and alkaline salts over country. *S. brachiata* is one of the most important halophyte which can be used to reclaim such soils. Further, in the future scenario of frequent sea intrusions and resulting salt contamination, the *S. brachiata* can be used for quick reclamation of such contaminated soils. In the research farm of Coastal Salinity Research Station, Navsari Agricultural University, Gujarat this halophyte is being cultivated and promoted for improving the economic status of coastal farming communities. The other Government Organizations like Department of Science and Technology and Central Salt and Marine Chemicals Research Institute (CSMCRI) are making efforts in popularizing the cultivation of Salicornia and in developing products. Agrotechnology of *S. brachiata* has been standardized by CSMCRI and disseminated to the farming community. Taking advantage of monsoon, seeds are broadcasted and naturally densified along the sea coast at various locations in Gujarat. The cost of cultivation is very low since natural inundation of seawater can take care of irrigation.

New report of rice hispa on wheat in Himachal Pradesh

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The rice hispa, *Dicladispa armigera* (Oliver) (Coleoptera: Chrysomelidae) which was earlier known to be a sporadic pest of paddy is now emerging as an important pest. In India, in the past few years, it has also gained major pest status particularly in states of Assam, Bihar, Uttar Pradesh, Himachal Pradesh and Odisha causing considerable economic loss. In last week of March 2016, it was observed attacking wheat crop at Malan. The feeding on leaves was quite visible though damage was not severe. Three to eleven adults per 50 m^2 were recorded. This is the first report of rice hispa on wheat from Himachal Pradesh. Field observations recorded in early June showed the occurrence of rice hispa adults on various weeds (*Cyanadon dactylon* (Linn.), *Cyperus rotundus* (Linn.), *Andropogon gayanus* (Kunth), *Digitaria sanguinalis* (Linn.) and *Panicum dichotomiflorum* Michx., etc) and they were found associated with paddy crop from July to November. During winter months (November-December) and autumn (Feburary-April), the adults were found on weeds and standing wheat crop, respectively (Table 1). However, egg-laying was recorded both on weed hosts and wheat. Kadappa *et al*. (2014) also reported rice hispa feeding on wheat from Punjab during 5-11 SMW.

Table 1 Survival of *D. armigera* under field conditions

Season	Period	Host
Summer	June	Weed hosts/paddy nursery
Kharif	July-mid Nov	Paddy crop
Rabi	Nov- Dec	Weed hosts
	Feb-April	Weed hosts/ Wheat crop

Phenotypic characterization of recombinant inbred lines (RILs) of rice for resistance to planthoppers

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Focused breeding program to develop superior lines with resistance to planthoppers namely brown planthopper (BPH) and whitebacked planthopper (WBPH) was initiated at ICAR-IIRR, Hyderabad. In the present study, a set of 1000 RILs developed from four crosses namely, TN1 / Ptb 33, TN1 /Sinna sivappu, Samba Mahsuri /MO1 and NDR359 /MO1 were screened in hotspot, Maruteru, Andhra Pradesh for resistance to BPH and WBPH for three successive years 2012-14.

Hopper infestation was heavy in 2012 during reproductive stage of the crop. Under severe hopper burn conditions, a set of 60 RILs derived from 4 crosses were found to be resistant (DS: 3 to 4.5). They survived and remained green without wilting and produced seed. The insect pressure was so high that only resistant RILs designated as RP 5448-RIL-501, RP 5448-RIL-311, RP 5448-RIL-526 and RP 5448 -RIL-112 obtained from the cross TN1/PTB 33; RP 5449-RIL-320 from TN1/ Sinnasivappu, RP 5425-RIL-216 from Samba Mahsuri/ MO1and RP 5316-RIL-243 from NDR 359/MO1 could withstand WBPH infestation as high as 600 per hill during kharif, 2012 and 790 BPH insects during rabi, 2012 with a damage score of three. On TN1, the susceptible check, 800-1000 WBPH (Kharif, 2012) and 1200-2000 BPH (Rabi, 2012) were found feeding. The remaining RILs showed moderate resistance to susceptible reaction.

During the year 2013 of the 60 resistant RILs only 30 RILs including RP 5448-RIL-501, RP 5448-RIL-311,

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RP 5448-RIL-526 and RP 5448-RIL-112 and RP5449-RIL-320 showed consistent resistant reaction for plant hoppers with damage scores ranging from 3.2 to 4.0 under heavy population pressure of 350-515 BPH and 80-130 WBPH per hill during Kharif and 500-600 BPH and 5-10 WBPH per hill during Rabi 2013 (DRR Newsletter, 2015).

Screening was repeated during 2014 to examine the stability of identified resistance levels. Interestingly 15 RILs inclusive of a common set of five resistant RILs reported under heavy infestation of 390-450 BPH and 25-33 WBPH per hill in 2012 and 2013 registered resistant reaction (damage scores of 3- 3.4) under hopper burn conditions (Fig 1& Table 1) during 2014 Kharif and 600-800 BPH and 30-40 WBPH insects per hill during 2014 Rabi.

For confirmation of the observed field resistance, glasshouse screening test was conducted during seedling stage for response to BPH and WBPH infestation separately during Kharif and Rabi seasons of 2013 and 2014 at IIRR, Hyderabad. Ten to twelve days old test seedlings along with standard susceptible (TN1) and resistant checks (Ptb 33) were infested with 2nd instar nymphs with an average of 8 to 10 nymphs per seedling following 'standard seed box screening test'. In glasshouse many of the field resistant RILs appeared to be susceptible at seedling stage. However only 5 RILs designated as RP 5448-RIL-501, RP 5448-RIL-311, RP 5448-RIL-526, RP 5448-RIL-112 and RP5449-RIL-320 showed resistant reaction to BPH (DS: 2.8 to 4) and WBPH (DS: 3 to 3.2) during 2013. In year 2014 also they exhibited resistance against both the pests, BPH (DS: 3-3.5) and WBPH (DS: 3-3.6) (Fig 2 & Table 1). The resistant checks, Ptb 33 and MO1 for BPH and WBPH recorded damage scores of 3 and 2.9 respectively.

Based on 3 years performance, 5 RILs designated as RP 5448-RIL-501, RP 5448-RIL-311, RP 5448-RIL-526 and RP 5448-RIL-112 derived from the cross TN1/Ptb 33; and RP5449-RIL-320 from the cross TN1/Sinnasivappu showed reproducible resistance to planthoppers during 2012, 2013 and 2014 in the field as well as glasshouse conditions. These RILs could serve as promising sources of resistance in breeding programs for developing resistant varieties against planthoppers.

Field screening in hotspot location (Mixed population of BPH and WBPH) at Maruteru

Glasshouse screening (BPH) at ICAR-IIRR, Hyderabad

Table 1: Reaction of RILs in the field and glasshouse to planthoppers

Cross/Designation	Field PH, 2014	Glasshouse BPH 2014	Glasshouse WBPH 2014
TN1/Ptb 33			
RP5448-RIL-501	3.4	3.4	3
RP5448-RIL-311	3	3	3
RP5448-RIL-526	3.1	3	3.6
RP5448-RIL-112	3	3	3

Cross/Designation	Field PH, 2014	Glasshouse BPH 2014	Glasshouse WBPH 2014
TN1/ Sinnasivappu			
RP5449-RIL-320	3	3.5	3.5
TN1 (Susceptible check)	9	9	9
Ptb33 (Resistant check-BPH)	3	3	-
MO1 (Resistant check -WBPH)	3	-	2.9

Neem coated urea enhances rice grain yield under irrigated ecosystem of India

Mangal Deep Tuti, R. Mahender Kumar, B. Sreedevi, Soumya Saha and Aarti Singh

ICAR-IIRR, Hyderabad-500030

Nitrogen fertilization plays a major role in increasing the rice productivity. In India prilled urea is being replaced with neem coated urea (NCU). To evaluate the performance of NCU applied at different stages of irrigated rice a trial was conducted at 18 centres (Aduthurai, Arundhatinagar, Coimbatore, Cuttack, Gangavathi, Jagdalpur, Karjat, Kaul, Kota, Ludhiana, Malan, Mandya, Navsari, Pantnagar, Pattambi, Phondaghat, Titabar and Ranchi) in *kharif* 2016. The trial was laid out in randomized block design with 8 treatments *i.e.*, T_1: 100% prilled urea applied as 3 splits (basal, maximum tillering and panicle initiation); T_2: 75% NCU applied as 3 splits (basal, maximum tillering and panicle initiation); T_3: 100% NCU as 3 splits (basal, maximum tillering and panicle initiation); T_4: 125% NCU as 3 splits (basal, maximum tillering and panicle initiation); T_5: 100% NCU as basal; T_6: 100% NCU as 2 splits (50% at basal and 50% at maximum tillering); T_7: 100% NCU as 2 splits (75% at basal and 25% at maximum tillering) and T_8: No fertilizer application. Overall mean grain yield revealed that 125% NCU in 3 splits (basal, maximum tillering and panicle initiation) resulted in highest grain yield of 5.34 tonnes/ha across 18 locations (Fig. 1). However, it was at par with 100% NCU as 3 splits (basal, maximum tillering and panicle initiation) with grain yield of 5.22 tonnes/ha. The rice yield under 100% NCU was 7% higher than that of 100% prilled urea (4.88 tonnes/ha).

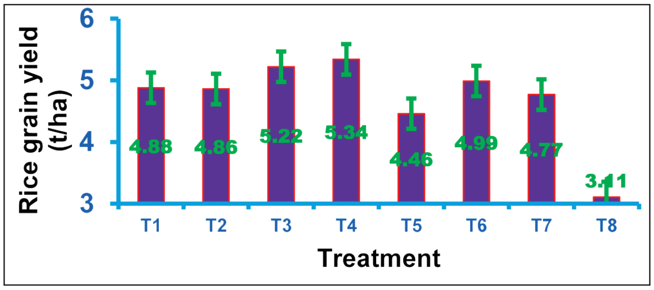

Fig.1. Effect of split application of NCU on rice grain yield

Acknowledgements: To all the co-operators of AICRIP-Agronomy

Morphological characterization of *Bipolaris oryzae* isolates causing brown spot disease of rice

Valarmathi P, Ladhalakshmi D, Laha G S, Prakasam V, Kannan C, Krishnaveni D and Srinivas Prasad M

ICAR-IIRR, Hyderabad-500 030

Rice is susceptible to several leaf spot diseases including blast and brown spot, which cause significant yield losses worldwide. Brown spot of rice caused by *Bipolaris oryzae* (*Cochliobolus miyabeanus*) is of worldwide occurrence which causes substantial quantitative and qualitative losses in grain yield. Studies have been initiated for morphological characterization of *B. oryzae* isolates causing brown spot disease of rice. A total of seventeen samples of rice leaves infected with *B. oryzae* were collected from Andhra Pradesh, Chattisgarh, Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Telangana, Uttar Pradesh and West Bengal of India. The fungus, *B. oryzae* was isolated from single discrete lesion from the infected leaf tissue followed by incubation for 2-3 days and further mycelial growth was sub cultured. The purified cultures were maintained on potato dextrose agar (PDA) slants at 4°C. The colony morphology with respect to colour and growth behaviour was observed 5 days after inoculation among all the 17 isolates of *B. oryzae* on PDA medium. The pattern of growth of *B. oryzae* among isolates showed significant differences with the range of means varying from 3.6 cm (BO 13 & BO 15) to 2.1 cm (BO 9) with five days after inoculation on PDA. Based on colony morphology and growth pattern, the 17 isolates of *B. oryzae* were characterized and formed four groups (Table 1). These were (Group I) black with fluffy growth, (Group II) grey with fluffy growth and white spots, (Group III) grey with fluffy growth and (Group IV) grey with suppressed growth (Fig.1). Isolates BO 2, 4, 8, 15 & 16 were under group II wherein isolates BO 12, 13 & 14 were under group I. Of all the isolates, those of Group II and III had the highest frequency (29.4 %) in the population, whereas Group I had the lowest frequency (17.6 %).

Table 1. Grouping of isolates of *Bipolaris oryzae* based on morphological characteristics

Group	Colony morphology	Population		Isolates nos.
		Number	Percentage	
I	Black with fluffy growth	3	17.6	BO 12, 13 & 14
II	Grey with fluffy growth & white spots	5	29.4	BO 2, 4, 8, 15 & 16
III	Grey with fluffy growth	5	29.4	BO 1, 6, 9,10 & 17
IV	Grey with suppressed growth	4	23.5	BO 5, 7, 3 & 11

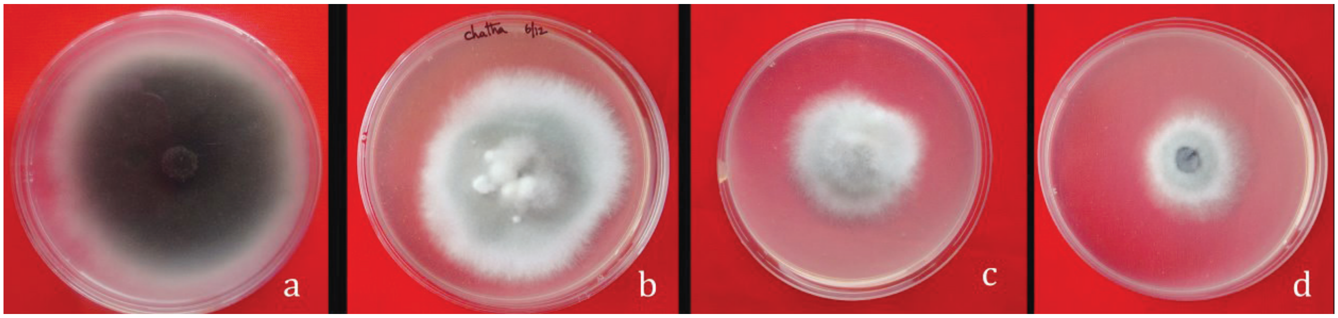

Fig.1: Colony morphology of *Bipolaris oryzae* isolates
Group I- Black with fluffy growth (a) Group II- Grey with fluffy growth & white spots (b) Group III- Grey with fluffy growth (c) Group IV- Grey with suppressed growth (d).

EMS mutants as novel source of tolerance to rice yellow stem borer

[1]Padmakumari, A.P., [1]Sheshu Madhav, M., [1]Umakanth. B., [1]Sunil, B., [1]Gopi, P., [1]Karteek, J., [1]Laha, G. S., [1]Sundaram, R.M., [1]Subba Rao, L.V., [2]Patel, H. K. and [2]Sonti, R. V.

[1]ICAR-IIRR, Hyderabad-500 030, Hyderabad-500 030

[2]CSIR- Centre for Cellular and Molecular biology- Hyderabad.

Yellow stem borer, *Scirpophaga incertulas* (Walker) is a dominant pest of rice affecting the crop at all the stages of the crop growth resulting in significant yield losses. As there are no sources of resistance to YSB are available in the primary gene pool of *Oryza*, there is a great need to search for new sources. The EMS mutagenized population developed under collaborative project between ICAR-IIRR and CSIR-CCMB were screened for enhanced tolerance to yellow stem borer in a phased manner across five seasons (Rabi 2013- 2015) at both vegetative and reproductive phases by augmenting the natural pest infestation through artificial releases. Damage was assessed as both dead hearts (DH) (symptoms at vegetative phase of rice plant) and white ears (WE) (symptoms at reproductive stage) at each of the crop growth stages on Standard Evaluation System (SES) (IRRI, 2014) scale. Evaluation of the M2 lines, advancement of the promising lines and reconfirmation of the promising lines was carried out simultaneously till M6 generation. Out of the 5000 M2 families screened in the field, nine mutants were identified as tolerant to yellow stem borer. These nine lines were also evaluated in stem borer screening trial (SBST), a multi location trial under AICRP- Entomology programme for three seasons (*Kharif*-15, *Rabi* and *Kharif*-16). Three mutants *viz.,* RP5977-Bio-SB-9 (M-SMY-1;SM-92), RP5977-Bio-SB-5(M-SMY-2;SM74),RP5977-Bio-SB-10(M-SMY-3; SM48) were most promising exhibiting tolerance in terms of low damage score (mean DH score of 3, 3, and 4 and 1, 1, 3 of WE, respectively) and high grain yield despite stem borer damage with an increase of

14% grain yield over the wild type. In addition to this, to evaluate the performance of three identified lines, a field trial was also carried out in *kharif* 2017 at three locations in farmers' fields under unprotected and protected (farmers practice) conditions. In farmers practice insecticide application (Ferterra granules @5kg/ha) was taken up at 25 days after transplanting. Field incidence of white ear was low in M-SMY-3 (1.3%WE) and M-SMY-1(2.2%WE) in unprotected condition. Incidence in M-SMY-2 was high (10.3% WE) in unprotected condition, and with one granular application it was lowered to 3.75%WE and all the three lines gave an increased yield (5 to 8%) over wild type. Another mutant line, RP5977-Bio-SB-8 (MSM-93) exhibited field tolerance despite damage and out yielded the wild type by 17% under infested conditions. Molecular analysis with SSR markers in the promising YSB tolerant lines indicated similarity of >95% with the wild type genome. This is the first report of tolerance to yellow stem borer in an elite background. To understand the genetics of resistance in these mutants, one of the promising mutant was used for MUTMAP, a next generation sequencing strategy for detecting the mutated loci.

Bacillus subtilis: a probiotic bacterium for improving soil and plant health

P. C. Latha[1]*, M. S. Sagarika[2], Bandeppa[1], M. B. B. Prasad Babu[1], B. Sreedevi[1], C. Chandrakala[1] and K. V. Prasad Babu[1]

[1]ICAR-IIRR, Hyderabad-30, [2]Ph.D.Scholar, IGKV, RAIPUR.

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Desiccation resistant, spore forming gram positive bacteria isolated from the paddy rhizosphere was found to exhibit traits that beneficially modulate both the plant growth and soil properties (Fig 1). The bacteria produced phytohormones like indole acetic acid (182.26 μg / mL) and aminocyclopropane carboxylate deaminase (1.67 μg α-ketobutrate /μg cell protein) which can stimulate, sustain and protect plant growth under abiotic and biotic stresses. The bacterium also produces siderophore, an indication of its biocontrol potential and its capacity to improve bioavailability of micronutrients in the rhizosphere. Exopolysaccharide (1.86 μg / mL) levan production was observed in the presence of sucrose. In addition, the bacteria has the ability to improve nitrogen use efficiency as it possess dissimilatory nitrate reduction to ammonium/ nitrate ammonifying activity that can reduce the nitrogen losses due to denitrification and leaching, hence increasing nitrogen retention in soils.

The isolate was observed to colonize the rice root surface when co-cultured under hydroponic conditions (Fig 2). Soil inoculations with the bacterium resulted in increased hot water extractable soil carbohydrate (primarily extra cellular polysaccharides of microbial origin) content, by 0.79%, due to its survival and multiplication in soil. Gravimetric analysis of water evaporation characteristics of soils under *in-vitro* conditions also established that the loss of water from inoculated soil was much lower than uninoculated soil. The water content in inoculated soils was higher by 16.6% and 71.0% , compared to uninoculated soils, at two and six hours of drying respectively.

Based on nucleotide homology and phylogenetic analysis using 16S nrDNA gene sequencing, the isolate was identified as *Bacillus subtilis* (GenBank Accession Number: MF171124). Strains of *Bacillus subtilis* have long been used as probiotic bacteria, conferring humans with proven health benefits. Microorganisms that improve the health status of the plant by phytostimulatory, biopesticidal activity and impart faster adaptation of plants to environmental changes have become known in recent years as plant probiotics. This rhizosphere *Bacillus subtilis* isolate with potential to improve rice plant fitness is thus an appropriate candidate to be labelled as a plant probiotic bacteria.

Fig 1: *B. subtilis* on nutrient agar

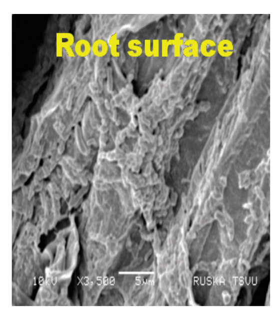

Fig 2: Scanning electron microscopy of colonized rice roots

PANORAMA OF INSTITUTIONAL ACTIVITIES

Research Advisory Committee Meeting

Research Advisory Committee (RAC) meeting of ICAR-IIRR was held during 13-14 June, 2017 under the Chairmanship of Dr. Darshan Singh Brar, Adjunct Professor, School of Agri- Biotechnology, PAU, Ludhiana. Members of RAC, Dr. I. S.Solanki, ADG (FFC), ICAR, New Delhi; Dr. Randhir Singh, ADG (Ag. Extn), ICAR, New Delhi; Dr. A. K Singh, Principal Scientist & Head, Division of Genetics, IARI, New Delhi; Dr Himanshu Pathak, Director, NRRI as a special invitee; Dr. D. Raji Reddy, Director of Research, PJTSAU, Hyderabad; Shri. A. Brahmaiah, Farmer representative, Dr. V. Ravindra Babu, Director, IIRR and Dr. R. Mahender Kumar, Head, Agronomy as member secretary attended the meeting. All the heads of the section and National Professor also attended the meeting. Dr. D. S. Brar appreciated the strong collaborative efforts of IIRR with CSIR- CCMB and DBT and the resultant awards. He applauded the outstanding work done by Drs. L. V. Subba Rao and V. Ravindra Babu under PPVFRA and the awards they received. Committee appreciated the efforts of IIRR scientists in addressing most of the recommendations made. P Krishnamoorthy (a renowned agronomist) low 'P' screening facility was inaugurated on 14th June and committee appreciated the efforts done in maintaining nematode sick plot. An interactive session with all the scientists of the institute was also held. RAC chairman and members were felicitated on 14th June 2017.

RAC meeting at IIRR

Inaugration of P Krishnamoorthy low 'P' screening facility at IIRR farm

International Yoga day

Third International Yoga day was celebrated at ICAR-IIRR on 21st June, 2017. Dr. M. Singa Rao (Retd. Professor, Acharya N. G. Ranga Agricultural University) demonstrated some of the *Asanas* and *Pranayama*. All the staff and students actively participated in the programme.

Demonstration of Asanas

Hindi *Pakhwada*

"Hindi *Pakhwada*" was celebrated at the Institute during 14th -27th September 2017. Various events and competitions were organised during the fortnight to motivate the staff to adopt Hindi in official work as well as research purposes. Mrs. Manisha Singh, Head, Department of Hindi, Delhi School of Excellence was the chief guest on valedictory function. Director (A) Dr. P. Ananda Kumar distributed trophies, certificates and cash awards to the winners of various competitions.

Competitions being organised in the institute to promote the use of Hindi

Prize distribution to the winners of various competitions

Swacch *Pakhwada*

As a part of the Swachh Bharat Mission, *Swacchata Pakhwada* was observed at the institute from 15th September- 2nd October, 2017. The staff voluntarily undertook various activities such as cleaning the institute premises and cleaning of nearby tourist spot, Himayat Sagar Lake. Cleaning and beautification of ICRISAT farm was also undertaken. As a part of the programme various competitions were held to school children and on the closing day prizes were distributed to the winners. Staff, who contributed towards the maintenance and cleanliness of the institute, were also awarded. The *pakhwada* ended with the remarks by Director (A), Dr. P. Ananda Kumar about Mahatma Gandhi's vision of clean India.

Staff members of IIRR cleaning the nearby tourist spot 'Himayat Sagar lake'

Staff members cleaning and beautifying the IIRR- ICRISAT farm

- ✧ The 89th Birth anniversary of Late Padmashri Dr. M. V. Rao was organized at the Institute in collaboration M. V. Rao Foundation in the SVS Shastri Auditorium on 21st June 2017.
- ✧ Commemorating the "Quit India Movement" during independence struggle a "*Sankalp se Sidhi* Pledge" was administered to the staff of the Institute on 9th August 2017.

- The Independence Day celebrations were organized at Institute and RC Puram farm. Director (A) hoisted the Flag on 15th August 2017.
- *Sadbhavana Diwas* was organized on 18th August 2017 and a pledge was taken by the staff of the Institute.

Trainings, Workshops and Meetings

- **52nd Annual Rice Research Group Meeting** was held at Assam Agril. University, Jorhat 8-11 April 2017.
- **Training cum demonstration program on Vermiculture and Organic farming** was organized on 2 April 2017 for farmers of Nalgonda. The program was sponsored by an NGO, BLESS from Nalgonda District, Telanagana. The training program was coordinated by Drs. P. Muthuraman and B. Nirmala
- **Training Program on Rice Production Technology** was organized for the farmers of Sambalpur District of Odisha during 4-5 May 2017. The training program was coordinated by Drs. Amtul Waris and B. Nirmala.
- **Rice Millers Meet** was organized on 22 June 2017 to discuss issues related to rice quality for export and consumption. Representatives from Agro input agencies also participated in the meeting.
- **Awareness Program on Crop Insurance Scheme of Government of India** was organized on 6 May 2017 at Pocahmpally village of Nalgonda district of Telangana. The farmers were apprised of the benefits of the crop insurance scheme. The program was coordinated by Drs. Amtul Waris and B. Nirmala.

Awareness Program on Crop Insurance Scheme

- **Training program on methodology for data collection** on the economics of conventional and system of rice intensification (SRI) rice cultivation for benefit of the staff of NGO, BLESS on 16 August, 2017.

Training program on economics of SRI

- **One day Training program on Rice Production Technology** was organized for the farmers of Sambalpur District of Odisha on 18 August 2017.

Farmers training program on "Rice production technology" for farmers of Odisha

- **Five days Training program on Rice Production Technology** was organized for the farmers of Valsad, Gujarat on during 21-24 August, 2017.
- **Four days Training program on Rice Production Technology** was organized for the farmers of Betul, Madhya Pradesh on during 28-31 August 2017.

Training program on 'Improved rice production technologies' for farmers of Madhya Pradesh

- **One day Training program on Rice Production Technology** was organized for the farmers of Yadadri District, Bhuvanagiri, Telangana on 4 September 2017.
- **Four days Training program on Rice Production Technology** was organized for the farmers of Anand, Gujarat during 16-18 September, 2017.

Training program on 'Advanced rice production technology for farmers of Gujarat

- **A Module II Certified Farm Advisor Program was organized at ICAR-IIRR**, from 11-25 September 2017. The program was sponsored by MANAGE, Hyderabad. Agriculture officers from various parts of the country were trained in rice production technology.

Certified Farm Advisor Program, sponsored by MANAGE

- **One day training programme on "e Procurement** was organized for administrative staff on 9 May 2017. Mr. Y. S. Murthy from NIC briefed the concepts and methodology involved.

STAFF ACTIVITIES

Deputations:

- Dr. Shaik Meera attended IGAD and RDA plenary meeting at University of Barcelona, Spain during 3-7 April 2017.
- Drs. V. RavindraBabu, and A. S. Hari Prasad visited Indonesia, Malaysia, Thailand, Vietnam and Cambodia to understand the overall rice cultivation and production systems by public sector organizations during 20-30 May 2017.
- Dr. Chitra Shanker, Principal Scientist attended the International Symposium on Biological Control of Arthropods (ISBCA- 2017) during 11-16 Sep, 2017 at Langkawi, Malaysia.
- Dr. B. Sreedevi, Principal Scientist attended the 26 Asia-Pacific Weed Science Society Conference (APWSS 2017) at Kyoto, Japan during 19-22 Sep 2017.
- Mr. Somya Saha, Scientist deputed for doctoral research at UBKV, Cooch Behar, West Bengal on study leave.

Joining & Transfers:

- Mr. Basavaraj, Scientist (Plant Pathology) joined at ICAR-IIRR on 15-04-2017
- Ms. Suvarna Rani Chimmili, Scientist, (Plant Breeding) joined at ICAR-IIRR, on 17-04-17
- Mr. B. Sathish, SAO joined at ICAR-IIRR on 24-04-17 on transfer from ICAR-NRC, Banana
- Shri. K. Srinivasa Rao, FAO Transferred to IIOR, Hyderabad from ICAR-IIRR, Hyderabad
- Shri. Ajay Kumar Maheswari, FAO joined ICAR-IIRR on 28-04-2017 on transfer from ICAR-IISR, Indore.
- Dr. J. Aravind Kumar, Senior Scientist (Plant Breeding) joined on 07-07-17 on transfer from ICAR-CAZRI, Jodhpur.
- Dr. P. Valarmathi, Scientist (Plant Pathology) transferred to ICAR-CICR, Nagpur w.e.f. 24-06-2017

Promotions:

- Dr. P. Jeya Kumar, Sr. Scientist promoted to Principal Scientist w.e.f. 15-11-12
- Dr. B. Sailaja, Sr. Scientist promoted to next higher grade of Principal Scientist w.e.f 31-12-15

Superannuations:

- Dr. N. Sarla, Principal Scientist (Biotechnology) : 30-4-2017
- Dr. T. Ram, Principal Scientist (Plant Breeding) : 30-4-2017
- Mr. B. P. Anjaneyulu, Technical Officer (T-5) (Agronomy) : 30-4-2017
- Dr. V. Ravindra Babu, Director : 30-06-2017
- Shri. E. Ramulu, Supporting Staff : VRS w.e.f. 05-08-2017

OBITUARY

Mr. Gajjala Ashok Reddy, Technical Officer

Mr. Gajjala Ashok Reddy was born in a farm family in Patelguda village, R. R. District, Telagana in the year 1970. He completed his Graduation and Post Graduation from Osmania University. He joined ICAR-IIRR as a Technical help in the Plant Breeding section in the year 1996 and subsequently was selected for the post of Technical Officer (T-3) in the year 1998 in Biotechnology Section. He was an efficient worker and efficiently maintained laboratories and field experimental plots. He was a member of the collaborative team from ICAR-IIRR and CSIR-CCMB, which developed the rice variety, Improved Samba Mahsuri. He was also a part of the team that developed bacterial blight resistant versions of the elite rice variety, Triguna and hybrid rice parental lines, KMR3R and IR58025B. He co-authored fourteen research papers in National and International Journals. Mr. Reddy suffered from brain injury in 2012 and was under prolonged treatment since then. He succumbed to brain haemorrhage on 19-04-17. With the demise of Mr. Reddy, the Institute lost an intelligent and dedicated worker with rich experience in rice breeding. He was survived by his wife, a son and a daughter. ICAR-IIRR family conveys deepest condolences to Mr. Reddy's family and pray to the almighty that his soul may rest in peace.

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