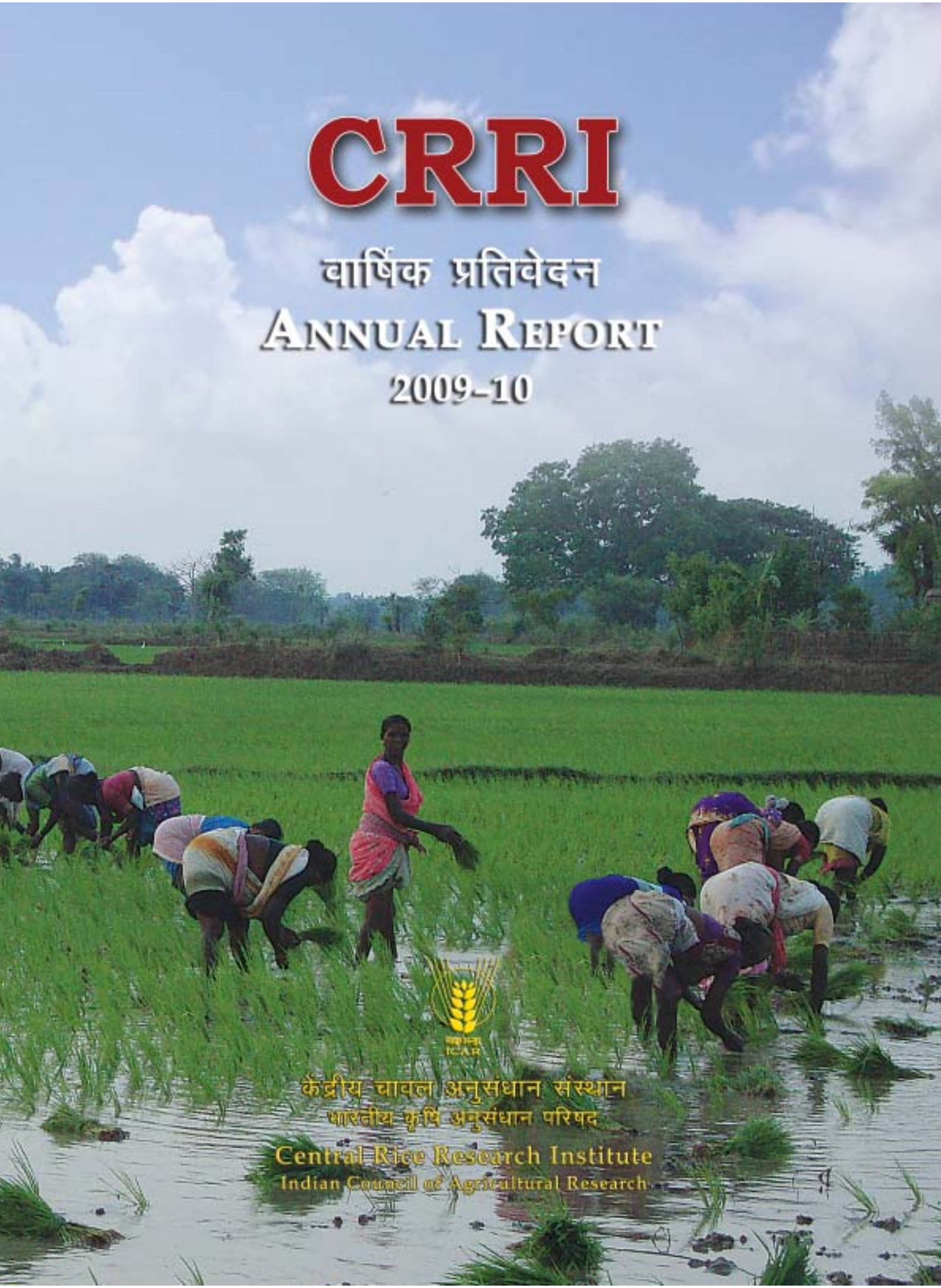
CRRI

वार्षिक प्रतिवेदन
ANNUAL REPORT
2009-10



केंद्रीय चावल अनुसंधान संस्थान
भारतीय कृषि अनुसंधान परिषद

Central Rice Research Institute
Indian Council of Agricultural Research

CRRI

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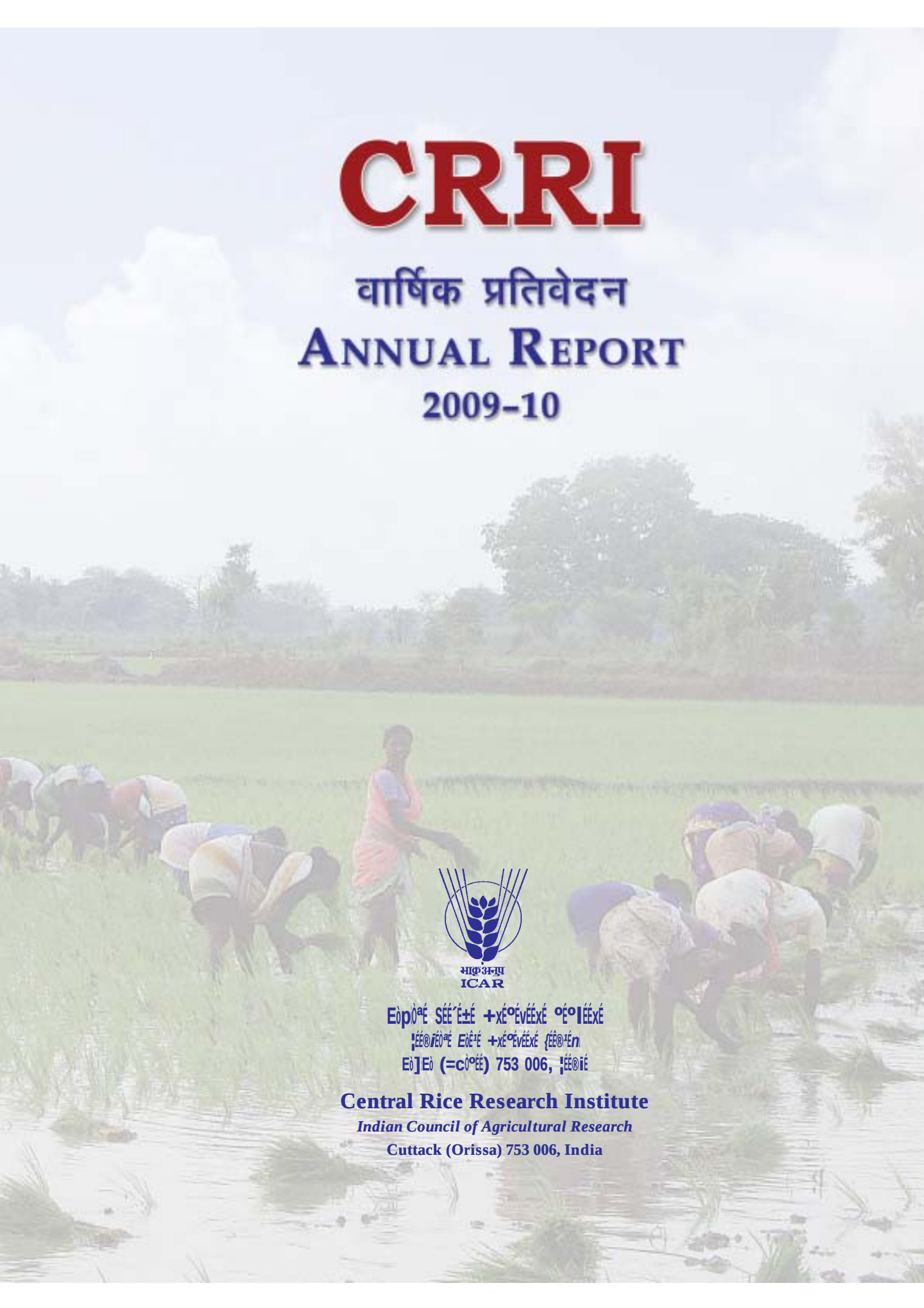

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Central Rice Research Institute

Indian Council of Agricultural Research

Cuttack (Orissa) 753 006, India

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Cover 1, 4: Farmers in village Parapadi in Thanjavur district of Tamil Nadu transplant a CRRI rice variety. Availability of water for cutivation is a major constraint. The CRRI has been evolving technologies to overcome these constraints and other stresses. (Photo: Ravi Viswanathan)

Cover 3: Past history and activities at CRRI. From top: Pandit Jawaharlal Nehru visited CRRI, Cuttack (Photo: CRRI Photolibrary); the CRRI started functioning from this building in 1946 under the guidance of Dr K. Ramiah; transgenic rice lines in the transgenic greenhouse; screening of lines for resistance to diseases; the microbiology laboratory; a view of the experimental fields at the CRRI, Cuttack. (Photos: Ravi Viswanathan)

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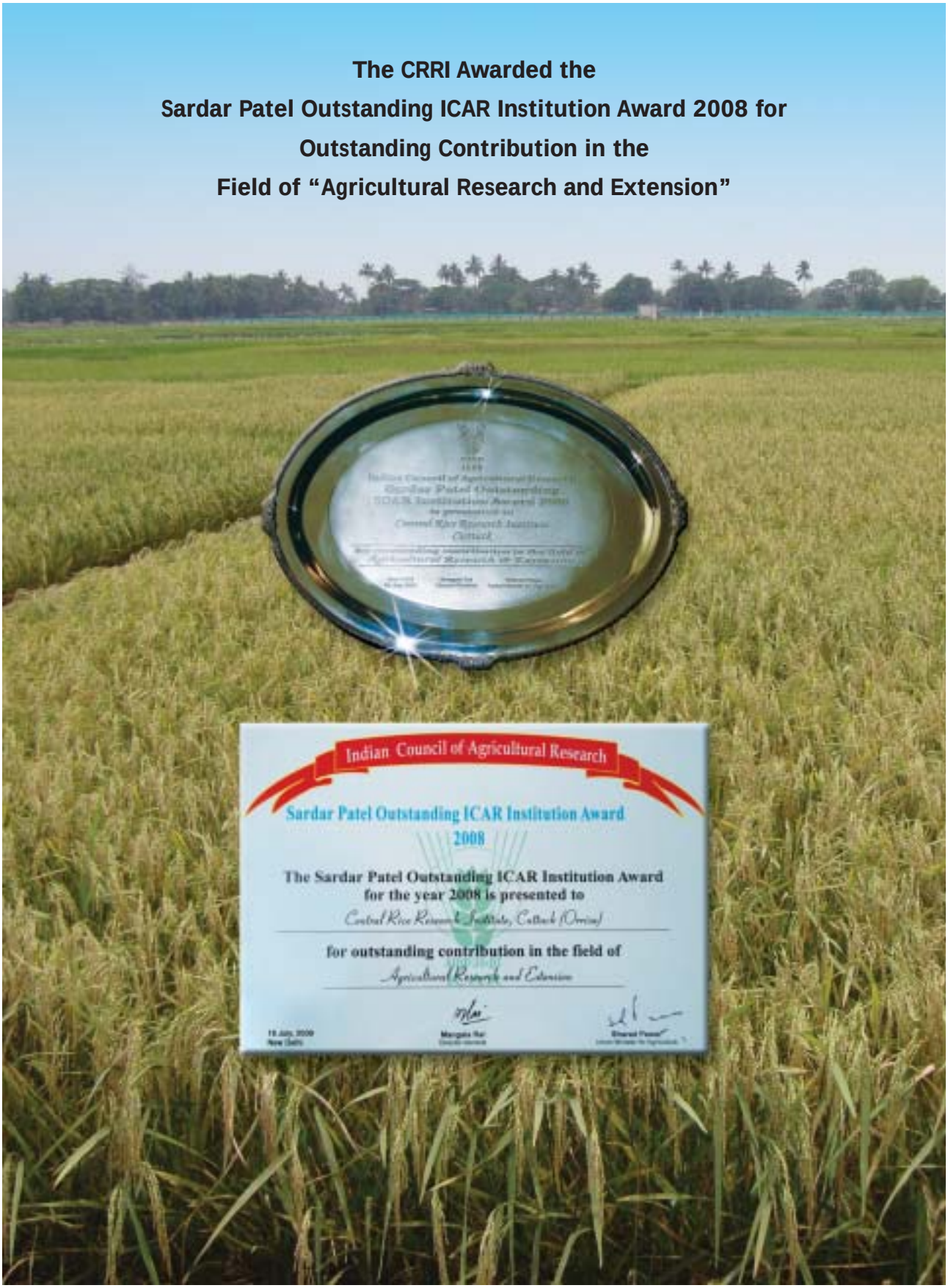
The CRRI Awarded the Sardar Patel Outstanding ICAR Institution Award 2008 for Outstanding Contribution in the Field of "Agricultural Research and Extension"



Preface

ADVERSE impacts of the climatic conditions offer immense opportunities to identify, modify and develop new lines of rice that can adapt to these fluctuations. The CRRI utilized these fluctuating weather patterns to ameliorate the hardships of farmers by evolving newer technologies and releasing rice varieties suitable for such conditions.

Drought, waterlogging and submergence have been the major hurdles for the farmers to obtain desirable yields. The CRRI has addressed these issues by releasing rice varieties that can tolerate these stresses. The farmer now has varieties that give him a return on his investment even under these adverse climatic conditions.

The CRRI has been upgrading its research facilities with state-of-the-art equipments that will bring out cutting-edge technology in real-time to the farmers. Research has been intensified to tackle resurgence of diseases and pests. The technologies that are being developed and tested as part of the "National Agricultural Innovation Projects" will provide newer tools to the farmers by accelerating research in frontier areas of concern.

In recognition of its services to the farmers the CRRI was awarded the "Sardar Patel Outstanding ICAR Institution Award 2008" for Outstanding Contribution in the Field of "Agricultural Research and Extension."

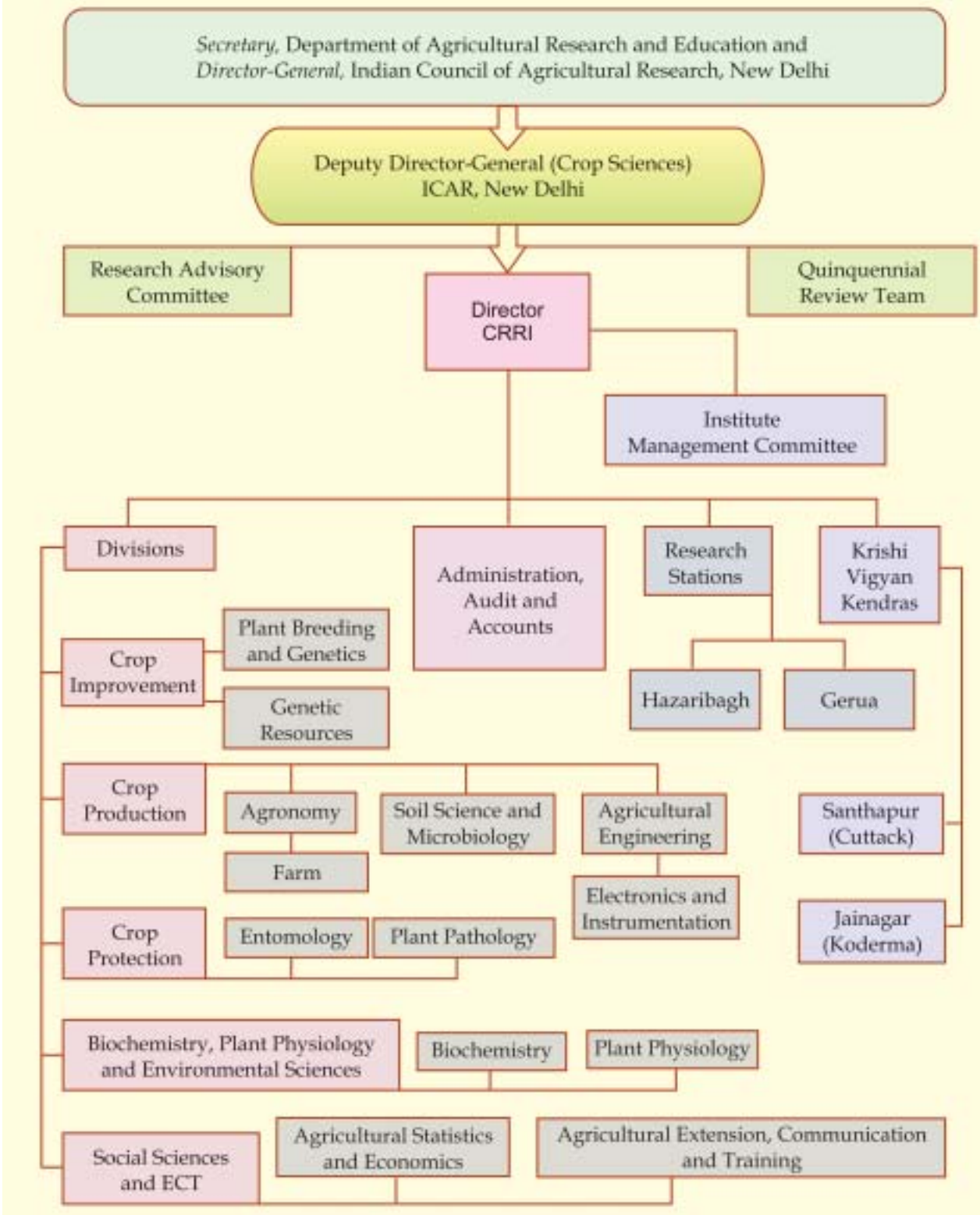
I am sure that this Annual Report will be useful for Research Managers, Researchers, Farmers and Students.

(T.K. Adhya)
Director

Contents

Organogram of

Central Rice Research Institute
Indian Council of Agricultural Research
Cuttack (Orissa) 753 006, India



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Executive Summary

DROUGHT-tolerant rice Sahbhagi Dhan (IR 74371-71-1-CRR-1; IET 19576) was released for cultivation in drought-affected areas of Jharkhand and Orissa.

Submergence-tolerant rice Swarna-*Sub1* (CR 2539-1; IET 20266) was released for cultivation in shallow lowland areas of coastal Orissa.

Superfine rice CR Dhan 801 (CRAC 2224-1041; IET 18720) was released for cultivation in bunded uplands and irrigated areas of Orissa.

Semi-dwarf, non-lodging, CR Dhan 401 (CR 780-1937-1-3; IET 19969) was released for cultivation in shallow lowlands of Orissa.

Tall, salt-tolerant, non-lodging, CR Dhan 402 (CR 2096-71-2; IET 18697), and non-lodging, salt-tolerant, CR Dhan 403 (CR 2095-181-1; IET 19470) were released for cultivation in coastal saline areas of Orissa.

Aromatic, photosensitive, CR Dhan 901 (Chinikamini Selection; IET 18394) developed through pure line selection from Chinikamini was released for cultivation in rainfed shallow lowlands and late-irrigated conditions of Orissa.

Tall, erect, non-lodging, CR Dhan 501 (CR 2008-111; IET 19189) was released for cultivation in semi-deepwater areas of Uttar Pradesh as a replacement of of Jalapriya, and in Assam as a replacement of Badal.

Semi-dwarf, CR Dhan 601 (CRG 1190-1; IET 18558) was identified as promising for *boro* areas of Orissa, Assam and West Bengal.

Dwarf, high-yielding, CR 898 (IET 17612), developed through gamma irradiation was identified as promising for *boro* areas of Assam and Orissa.

Erect, rice hybrid (CRHR 5; IET 19600) was identified as promising for *boro* areas of Orissa and Assam.

Medium-tall, rice hybrid CR Dhan 701 (CRHR 32; IET 19576) ZÉÉ®JÉb iÉlÉÉ =cÒºÉÉ Eò ºÉJÉÉ-{ÉÒÊciÉ lÉjÉÉ ¨É JÉiÉÒ Eò Ê±ÉB Ê´É¨ÉÉÉSÉiÉ ÊEòªÉÉ MÉªÉÉ*

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IET 20852) was identified as promising for late-irrigated / shallow water areas of Bihar and Gujarat.

IET 20220 (CR 2285-6-6-3-1) with good kneeing ability was identified as promising for deepwater areas in Orissa and Uttar Pradesh.

Rice germplasm were collected from 10 districts of Orissa and also from different districts of Chhattisgarh.

Rice germplasm were characterized for different traits.

Various trials were conducted for screening entries in the national (AICRIP) trials under different ecologies.

Various genotypes were evaluated for pre-flood *ahu* rice, post-flood s*ali* and for flash-flood.

Hybrid seed of 22 combinations were produced for conducting different trials.

Parental line improvement was taken up through population improvement and recombination breeding.

Based on performance in SLHRT during *kharif* 2009, hybrid CRHR 35 (IET 21702) was promoted to AVT-1 (L).

Hybrid CRHR 46 (IET 21300) ranked first in AVT-1 (L) and was promoted to AVT-2 (L). It stood first in Chhattisgarh, Bihar, West Bengal and Gujarat.

Hybrid CRHR 5 ranked first in the third year of testing in AL&ISTVT.

Twentyone second generation NPT genotypes were tested for yield, agronomic and other morpho-physiological traits.

Aromatic rice CR 2613-1-5-2-7-2 (IET 21271) was promoted from ASGON to IVT-ASG.

Intercropping rice Vandana with cowpea C 1111 gave higher rice equivalent yield than sole crop.

Citronella oil (*Cymbopogan nardus*) treatment in polybags containing grains of rice Dushara controlled population build-up of *Sitotroga cerealella* for six months under controlled conditions.

A study on the effectiveness of KVK programmes on sustainable development of farmers was conducted.

The Krishi Vigyan Kendras of Santhapur and

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Koderma conducted various training programmes, on-farm trials and frontline demonstrations.

Zero till cultivation under the guidance of KVK, Koderma was successful.

The meeting of the Research Advisory Committee (RAC), Institute Joint Staff Council (IJSC), Staff Research Council (SRC), and the KVK Scientific Advisory Committee (SAC) were held.

The 63rd Foundation Day of the CRRI, and Annual Review and Planning meetings of various projects were held.

The Hindi Fortnight 2009 and the Vigilance Awareness Week 2009 were conducted.

The CRRI participated in different exhibitions.

The Tournament of Eastern Zone (TEZ) 2010 was held at CRRI, Cuttack.

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A rainbow lights up the sky over the CRURRS, Hazaribagh. (Photo: M. Variar)

The CRRI: What is it and what it does?

THE CRRI was established by the Government of India in 1946 at Cuttack, as an aftermath of the great Bengal famine in 1943, for a consolidated approach to rice research in India. The administrative control of the Institute was subsequently transferred to the Indian Council of Agricultural Research (ICAR) in 1966.

The Institute has two research stations, one at Hazaribag, in Jharkhand, and the other at Gerua, in Assam. The CRRI-RRS, Hazaribag was established to tackle the problems of rainfed uplands, and the CRR-RRS, Gerua for problems in rainfed lowlands and flood-prone ecologies. Two Krishi Vigyan Kendras (KVK) also function under the CRRI, one at Santhapur in Cuttack district in Orissa and the other at Jainagar in Koderma district in Jharkhand. The research policies are guided by the recommendations of the Research Advisory Committee (RAC), Quinquennial Review Team (QRT) and the Institute Staff Research Council (SRC). The CRRI also has an Institute Management Committee (IMC), for formulating administrative policies.

Mandate

The goal is to improve the income and quality of life of rice farmers in India. The objectives are:

❄ Conduct basic, applied and adaptive research on crop improvement and resource management for increasing and stabilizing rice productivity in different rice ecosystems with special emphasis on rainfed ecosystems and the related abiotic stresses.

❄ Generation of appropriate technology through applied research for increasing and sustaining productivity and income from rice and rice-based cropping / farming systems in all the ecosystems in view of decline in per capita availability of land.

❄ Collection, evaluation, conservation and exchange of rice germplasm and distribution of improved plant materials to different national and regional research centres.

❄ Development of technology for integrated pest, disease and nutrient management for various farming situations.

❄ Characterization of rice environment in the country and evaluation of physical, biological, socio-economic and institutional constraints to rice production under different agro-ecological conditions and in farmers' situations and develop remedial measures for their amelioration.

❄ Maintain database on rice ecology, ecosystems, farming situations and comprehensive rice statistics for the country as a whole in relation to their potential productivity and profitability.

❄ Impart training to rice research workers, train-

ers and subject matter / extension specialists on improved rice production and rice-based cropping and farming systems.

❄ Collect and maintain information on all aspects of rice and rice-based cropping and farming systems in the country.

Thrust Areas

❄ Germplasm collection, characterization of genetic diversity and gene function assignment.

❄ Designing, developing and testing of new plant types, super rice and hybrid rice for enhanced yield potential.

❄ Identification and deployment of genes for nutrient deficiency, tolerance to submergence, drought, salinity and biotic stresses and productivity traits.

❄ Intensification of research on molecular host-parasite / pathogen interaction to design suitable control strategy.

❄ Understanding the pest genomics for biotype evolution, off-season survival and ontogency for integration into a control strategy.

❄ Developing nutritionally enhanced rice varieties with increased content of pro-vitamin A, vitamin E, iron, zinc and protein.

❄ Improvement of short-grain aromatic rice and organic management of aerobic rice.

Research Achievements

Released a total of 70 rice varieties including two hybrids for cultivation in upland ecology, irrigated ecology, rainfed lowland ecology, medium-deep waterlogged ecology, coastal saline ecology and deepwater ecology.

Maintains more than 30,000 accessions of rice germplasm including nearly 6,000 accessions of Assam Rice Collection (ARC) and 5,000 accessions from Orissa.

Compiled Passport information on more than 30,000 germplasm.

Developed late duration varieties for rainfed lowlands including hybrids.

Developed interspecific hybrid derivatives including *O. sativa* and *O. longistaminata* with tolerance to bacterial leaf blight (BLB).

Used RFLP / RAPD and other DNA markers for genetic analysis of bacterial blight, blast and gall midge resistance.

Used marker-assisted selection for pyramiding BLB resistance genes and for developing BLB-resistant rice cultivars.

Developed a rice-based farming system including rice-fish farming system integrating multiple enterprise initiatives with a rationale for ensuring food and nutritional security, stable income and employment generation for rural farm family.

Knowledge-based N management strategy for increasing N-use efficiency for rainfed lowlands including use of integrated N management involving use of both organic and inorganic sources of N-fertilizer.

Developed several agricultural implements such as manual seed drill, pre-germinated drum seeder, multicrop bullock and tractor drawn seed drill, flat disc harrow, finger weeder, conostar weeder, rice husk stove, mini parboiler and power thresher with the sole aim of reducing both drudgery and cost of rice cultivation.

Evaluated, developed and tested several plant products with pesticide potential against field and storage insects and pathogens.

Developed non-destructive screening technique based on chlorophyll fluorescence spectrophotometry to identify submergence tolerant rice germplasm.

Identified biochemical and biophysical parameters for submergence and other abiotic stress tolerance in rice.

Developed crop modelling of G x E interaction studies that showed that simulation of crop growth under various environments could be realistic under both irrigated and favourable lowlands situations.

Developed suitable rice production technologies for rainfed uplands, lowlands and irrigated ecology including production technologies for hybrid rice and scented rice that were field tested and transferred to farmers.

Evaluated and popularized its varieties through frontline demonstrations (FLD) in farmers' fields.

Provided farmers' advisory service through regular radio talks and TV telecasts on rice production technologies.

Developed 15 training modules for farmers and extension workers.

Imparted short-term and long-term training for personnel from the State Departments of Agriculture, State Agricultural Universities (SAU) and other educational institutions.

Imparted advance training and research leading to Masters (M.Sc.) and doctoral degrees (Ph.D.).

Linkages

The CRRI has linkages with several national and international organizations such as the Council for Scientific and Industrial Research (CSIR), Indian Space Research Organization (ISRO), SAUs, State Departments of Agriculture, and the institutes of the Consultative Group for International Agricultural Research (CGIAR), such as the International Rice Research Institute (IRRI), Philippines and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru.

Location

The Institute is located at Cuttack about 35 km from Bhubaneswar airport and 7 km from the Cuttack railway station on the Cuttack-Paradeep State Highway. The institute lies approximately between 85°55'48" E to 85°56'48" E longitudes and 20°26'35" N to 20° 27' 20" N latitudes with the general elevation of the farm being 24 m above the MSL. The annual rainfall at Cuttack is 1,200 mm to 1,500 mm, received mostly during June to October (*kharif* or wet season) from the southwest monsoon. Minimal rainfall is received from November to May (*rabi* or dry season).

Genetic Resources and Seed Technology

Genetic Resources

Exploration and Collection of Rice Germplasm

Ten districts of two agro-climatic zones in Orissa, the north-eastern coastal plains and the eastern and south-eastern coastal plains were surveyed. These areas were mostly occupied by farmers' varieties during *kharif*, and by HYVs during *rabi*.

One hundred and twentyseven accessions of landraces were collected from the districts of Jajpur, Cuttack, Balasore, Mayurbhanj, Keonjhar, Dhenkanal, Angul, Jagatsinghpur, Puri and Nayagarh in Orissa.

Collection, Characterization, Conservation of Medicinal and Specialty Rices

Thirty germplasm were collected during exploration and collection in the districts of Mahasamud, Raipur and Durg of Chhattisgarh.

Rejuvenation of Rice Germplasm

A set of 3,500 accessions of Indian rice germplasm that also included collections from Punjab and Orissa were grown in the experimental fields for seed increase and seed supply to different researchers as well as for maintenance of purity and viability.

Characterisation of Rice Germplasm including Wild Species

During *kharif* 2009, 507 germplasm accessions were characterized for morpho-agronomic characters.

The leaf length varied from 25.6 cm (AC 8199) to 75.3 (AC 9756).

The leaf width varied from 0.6 cm (AC 8810) to 1.7 cm (AC 9451).

The ligule length ranged from 1.2 cm (AC 8142) to 4.3 cm (AC 9261).

The plant height varied from 73.3 cm (AC 9167) to 191.6 cm (AC 9268).

The culm number ranged from 5.3 (AC 9054) to 15 (AC 8589).

The DFF ranged from 75 days (AC 8930) to 140 days (AC 9732).

Table 1. List of varieties and panicle progeny lines grown.

Variety	Progeny rows	Elimination		Selected
		Field	Lab	
Annada	200	6	2	192
CR 1014	200	3	0	197
CR Boro Dhan 2	210	26	14	170
CR Dhan 10	200	5	4	191
CR Sugandh Dhan 3	200	8	28	164
Dharitri	200	5	3	192
Durga	220	8	5	207
Gayatri	200	8	6	206
Geetanjali	200	6	1	193
IR 36	220	12	6	202
IR 64	220	8	5	207
Ketekijoha	200	12	7	201
Khitish	200	11	5	204
Lunishree	210	6	3	201
Moti	200	4	3	193
Naveen	230	20	5	205
Nua Kalajeera	200	7	15	178
Pooja	250	3	2	245
Ratna	200	38	6	156
Sarala	230	5	1	224
Satabdi	250	5	15	230
Savitri	200	10	2	188
Utkal Prava	200	5	3	192
Varshadhan	220	2	0	218

The single plant yield varied from 3.5 g (AC 8156) to 23 g (AC 9807).

The panicle weight ranged from 1.5 g (AC 9136) to 5.5 g (AC 8813).

The panicle length ranged from 17.3 cm (AC 9080) to 31.6 cm (AC 8830).

The grain number varied from 57.3 (AC 8968) to 301 (AC 8810).

Maintenance of Landraces, Identified Donors and Pre-breeding Lines of Floodprone Ecosystem and *Boro* rice

Four hundred and ninetyfour accessions of traditional *boro* rice were rejuvenated during the *boro* season. A set of 564 accessions of rainfed lowland rice germplasm of traditional varieties in addition to 70 other varieties were rejuvenated during *kharif* 2009 at Gerua.

Seed Research

Maintenance Breeding or CRRI Released Varieties and Nucleus Seed Production

The list of seed produced is given in Table 1.

Studies on Seed Invigoration for Improving Rice Productivity

Seed invigoration techniques help attain proper stand establishment while improving early vigour that provides the crop an edge over weeds. Two invigoration techniques and six seed rates were field evaluated during *kharif* 2009.

Interaction effects between invigoration techniques and seed rates were non-significant. Although the total number of tillers and panicles increased with increasing seed density, tillering (tillers / plant or panicles / plant) decreased with increasing seed density (Table 2).

Seed Production

The quantity of breeder seed produced is given in Table 3. The details of TL seed produced is given in Table 4.

Table 2. Effect of seed invigoration and seeding densities on productivity of upland rice, *kharif* 2009.

Treatment	Rice density (plant / m^2)	Tillers (number / m^2)	Tillers (number / plant)	Panicle density (panicles / m^2)	Panicle / plant (number)	Yield (t / ha)
Invigoration techniques						
Untreated seed	74	246	3.3	219	3	1.9
Seed hardening	79	256	3.2	240	3	2.1
LSD (0.05)	ns	18	ns	11	ns	0.1
Seeding densities						
50 seeds / m^2	48	224	4.7	210	4.4	1.7
100 seeds / m^2	56	238	4.3	218	3.9	2
150 seeds / m^2	78	251	3.2	238	3.1	2
200 seeds / m^2	84	262	3.1	244	2.9	2.2
250 seeds / m^2	94	269	2.9	250	2.7	2
300 seeds / m^2	109	284	2.6	265	2.4	2.1
LSD (0.05)	18	54	-	32	-	0.24

RRLRRS, Gerua

TL seed of rice Chandrama was produced.

Table 3. Quantity of breeder seed produced during the year.

Variety	DAC indent (t)	Quantity produced (t)
Hazaribag		
Abhishek	0.1	0.72
Anjali	0.3	0.45
CR Dhan 40	0.15	0.2
Sadabahar	0.3	0.13
Vandana	0.3	0.42
Virendra	0.3	0.18
Cuttack		
Annada	0.5	0.81
CR 1014	1.1	0.66
CR Boro Dhan 2 (Chandan)	0.1	0.12

Table 3. Quantity of breeder seed produced during the year.

Variety	DAC indent (t)	Quantity produced (t)
CR Dhan 10	-	0.33
CR Dhan 70	-	0.33
CR Sugandh Dhan 3	-	0.42
Dhanrasi	-	0.45
Dharitri	0.05	0.45
Durga	-	0.66
Gayatri	0.7	2.07
Geetanjali	0.4	0.43
Heera	0.05	-
IR 20	0.15	0.42
IR 36	8	2.15

Table 3. Quantity of breeder seed produced during the year.

Variety	DAC indent (t)	Quantity produced (t)
IR 64	2	1.76
Ketekijoha	0.4	0.41
Khitish	1.5	1.3
Lunishree	0.15	0.39
Moti	0.45	0.48
Naveen	8.1	12.6
Nua Kalajeera	0.05	0.33
Padmini	0.25	0.21
Pooja	4.1	11.16
Pusa 44	-	0.45
Ranjit	-	0.42
Ratna	1.2	0.73
Sahabhagi Dhan	-	0.12
Samalei	-	0.36
Sarala	2.2	2.1
Satabdi	4.8	12.18
Savitri	1.8	2.52
Swarna-*Sub1*	-	12.27
Tapaswini	-	0.84
Tulasi	-	0.24
Utkal Prava	0.7	1.17
Varshadhan	3	4.26
Ajay "A"	-	0.04
Ajay "B"	-	0.02
Rajalaxmi "A"	-	0.04
Rajalaxmi "B"	-	0.02
Ajay and Rajalaxmi "R"	-	0.04

Table 4. TL seed produced.

Variety	TL Seed (t)	Variety	TL Seed (t)
Cuttack		Swarna-*Sub1*	1.6
Ajay	0.1	Varshadhan	5
Anjali	1.5	Gerua	
Annada	3.6	Bahadur	0.28
Chandan	0.9	Bakul Joha	0.14
CR 1014	1.2	Chandan	0.78
Dhusara	0.5	Chandrama	2.8
Durga	1.8	CR 1014	0.31
Gayatri	12.8	Dichang	0.15
Geetanjali	0.2	Dikhow	0.17
Kalajeera	0.5	IR 36	0.17
Ketekijoha	2	IR 64	0.15
Moti	1.8	Joymati	0.42
Naveen	4.6	Kalong	0.22
Padmini	0.7	Ketekijoha	0.22
Pooja	11.2	Luit	0.21
Rajalaxmi	0.1	Mahsuri	1.5
Sahbhagi Dhan	10.3	Piolee	0.52
Sarala	7.4	Ranjit	2.6
Satabdi	1.8	Sabita	0.16
Satyakrishna	1.2	Swarna	0.09
Savitri	1.1	Tapaswini	0.39
Swarna	0.7		

Genetic Enhancement of Yield

Varietal Improvement for Rainfed Uplands

Development of Varieties Suitable for Unfavourable Uplands

Hybridization, Selection and Evaluation of Breeding Materials: Twentyfive new crosses were made to improve the grain quality, drought tolerance, early vigour and blast resistance besides grain yield of upland rice varieties during *kharif* 2009. Popular upland rice varieties (Vandana, Anjali and Kalinga III) and other elite advance breeding lines (RR 166-645, RR 345-2 and RR 354-1) were crossed as female parents with the identified donors for different traits in the hybridization programme. In the pedigree nursery for unfavourable uplands a total of 2,632 progenies and 20 F_2 populations were grown and 2,044 single plant and 115 uniform bulk selections were made from 246 crosses. In F_3, 537 single plant progenies were selected from 24 crosses. Based on plant type, panicle characters, reaction to abiotic and biotic stresses in 265 F_4, 176 F_5, 84 F_6, 32 F_7 and 15 F_8 generations and single plants were selected from 48 F_4, 47 F_5, 55 F_6, 6 $F_7$and 21 F_8 crosses. Besides these 115 uniform bulks were also selected for preliminary yield testing.

Preliminary Yield Trial: Sixteen aromatic long slender grain entries along with checks were evaluated with three replications and two treatments (seed treatment with Beam 75 and untreated control) following recommended packages of practices in rainfed unfavourable uplands. The trial was affected by severe drought during tillering and grain filling stages. Treatment effect was not found significant for grain yield as only one variety Sneha had high blast infection in the untreated control. The grain yield and flowering duration of the entries under two treatment levels are in Table 5. These entries being far superior in terms of grain quality may be promoted for further multilocation testing.

Table 5. Performance of the entries under two treatment level.

Entries	DFF		Yield (t/ha)	
	Treatment[1]	Control	Treatment	Control
RR 388-5	69	70	1.3	1.2
RR 361-17-1	55	55	1.3	1.2
RR 361-15	61	61	1.3	1.2
RR 361-16-1	55	55	1.2	1.5
CRR 388-1-8	64	63	1.2	1
RR 361-17-2	54	54	1.1	0.9
RR 388-4	69	71	1.1	1
RR 366-4	72	68	1.1	0.6
RR 361-14-2	55	56	1	0.9
CRR 388-1-9	62	63	1	0.9
RR 363-36	54	53	1	0.8
CRR 388-1-14	63	63	0.1	0.9
RR 363-13	63	62	0.1	0.8
CRR 388-1-7	64	64	0.9	0.9
Kalinga III	56	56	1.5	1
Sneha	61	61	1	0.7
Anjali	61	61	1.4	1.4
Vandana	70	71	1.4	1.5
LSD (0.05)	3	0.44		
CV (%)	3	25.5		

[1]Seed treated with Beam 75.

Performance of Cultures in National Coordinated Trials: In AVT-VE, a very early culture CRR 427-21-Bl-2 (IET 20871), ranked first under drought affected locations with yield superiority of 19% over national check

Table 6. Promising entries under AVT-VE and IVT-VE, *kharif* 2009.

Trial	Promising entry	Yield (t/ha)
AVT-VE	CRR 427-21BL-2	2.8
CRR	617-B-47-3	2.8
CRR	646-IR79971-B-60-B	2.7
	Anjali (best check)	2.3
	Mean	2.1
	CD (0.05)	0.47
	CV	13.7
IVT-VE	CRR 383-3	2.5
	CRR 646-B-12-B	2.5
	CRR 427-14Bl-1-1	2.4
	Anjali (best check)	2.2
	Mean	1.6
	CD (0.05)	0.5
	CV	15.4

Anjali, 24.8% over regional check Vandana and 8.6% over local checks on overall mean basis. Besides these, seven other cultures CRR 616-B-2-66-2, CRR 455-109, CRR 347-5, CRR 383-3, CRR 427-14Bl-1-1, CRR 646-B-12-B and CRR 614-IR74371-46-1-1 were also promoted from IVT-VE or E to AVT-VE/1E.

National Coordinated Trials

During *kharif* 2009 two coordinated trials AVT-VE and IVT-VE were conducted. The trials were affected due to moisture stress during tillering, flowering and grain filling stages. The performance is in Table 6.

Hybridization, Generation, Selection and Evaluation of Breeding Materials for Rainfed Semi-Aerobic/ Favourable Uplands

Variety Released: IET 19576 (IR74371-70-1-1-CRR-1) was released by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties of Agri-horticultural Crops as Sahbhagi Dhan for the drought-affected areas of Jharkhand and Orissa in 2009. Under national coordinated trial, it yielded of 2.1 t/ha under drought affected and 3.9 t/ha in normal rainfall conditions. Sahbhagi Dhan flowers in 78-80 days, has intermediate stature (85-90 cm), non-lodging characteristic with 5-8 effective tillers/plant. Sahbhagi Dhan is resistant to leaf blast (mean score 3.1, 2005–07, 22 locations) and moderately resistant to brown spot (mean score 4.5, 2005–07, 12 locations). It has long bold grains, HRR of 64.7%, alkali value of 7, intermediate amylose content (24.68%) and medium gel consistency (57 mm).

Hybridization, Selection and Evaluation of Breeding Materials: Thirtyfour new cross combinations were made with IR 64, IR 36, MTU 1010 and BPT 5204, and upland adapted/aerobic varieties ARB 7, Tripuradhan, Sukhawan Apo and Salumpikit. Segregating populations of different generations were evaluated and selections were made based on maturity duration, plant height, panicle length, number of grains/panicle, sterility percentage and disease and pest reaction. Six hundred and thirty single plant selections were made from 15 F_2 populations. 114 progenies from 10 crosses in F_3 generation, 76 progenies from three crosses in F_4, 64 progenies from five crosses in F_5 and 79 lines in F_6 from 10 crosses for further evaluation.

Preliminary Yield Trial: In PYT for favourable uplands 20 entries including popular check variety IR 64 were evaluated in three replications.

Among the test entries, CRR 389-9-2 (3.7 t/ha), CRR 272-29-1 (3.5 t/ha) and CRR 389-9-1 (3.5 t/ha) significantly outyielded the check variety IR 64 (2.8 t/ha) (Table 7).

IVT-IME trial was conducted under both irrigated control and rainfed stress conditions.

Table 7. Performance of promising entries under PYT, favourable uplands.

Entries	Yield (t/ha)
RR 272-28-2	3.4
RR 389-11	3.3
RR 389-7	3.3
RR 389-6	3.2
IR 64	2.8
LSD (0.05)	0.59

M. Variar

Drought-tolerant rice Sahbhagi Dhan (IR 74371-71-1-CRR-1; IET 19576) was released for cultivation in drought-affected areas of Jharkhand and Orissa.

Under control conditions RDN 98-2-3-5-14 (7.1 t/ha) and CR 2642-52 (7 t/ha) were the top-yielding entries, significantly out-yielding the best check, Abhishek (6.2 t/ha) (Table 9). Under rainfed very severe stress condition, CR 2642-52 (3.1 t/ha), RNSK 1088-7-3-1 (2.8 t/ha) and R 1570-2644-2-1547 (2.6 t/ha) were the better entries yielding more than 2.5 t/ha. CR 2642-52 was identified as the most promising entry combining very high yield potential with reproductive stage drought tolerance.

Development of Varieties with Weed Competitivity, Drought Tolerance and Better Harvest Index in Alluvial Soil of Eastern India

Hybridization was accomplished and F_1 cross seeds were harvested using IR 74371-70-1-1, Apo, IR 55419-4, Lalat, IR 64, Khandagiri and Naveen as female parents and Aday Sel CR 143-2-2, CR 143-2-2 and Salumpikit as male parents. Six hundred and eighteen selections (F_4-F_5) were made from seventeen crosses. Two hundred and thirtynine selections (F_5-F_6) were made from seventeen crosses. Sixtytwo derivatives of (IR 64/Aday Sel) were evaluated in RBD design with two replications. Thirtytwo promising selections were identified based on various yield attributing characters. The five best selection identified were IR 83641-589-B-B, IR 83641-564-B-B, IR 83641-603-B-B, IR 83641-885-B-B and IR 83617396-B-B. Selections IR 83641-589-B-B scored EVV (3) with no leaf rolling and no tip drying under severe drought conditions. It yielded 3.7 t/ha. IR 83641-564-B-B, IR 83641-603-B-B,

Table 8. Promising entries under AICRIP trials, *kharif* 2009.

Trial	Promising entry	Yield (t/ha)
AVT-1E	VNR 201	3.5
	NDR 1131	3.4
	CRR 508-RE4-B-A1	2.9
	Annada (best check)	2.2
	Mean	1.51
	CD (0.05)	0.7
	CV (%)	28.5
IVT-E	CRR 616-B-2-75-1	3
	CRR 614-IR74371-54-1-1	2.8
	TTB 122-33-1	2.8
	Annada (best check)	2.5
	Mean	1.39
	CD (0.05)	0.46
	CV (%)	16.5
AVT1E-Aero	CR 2623-IR 55419-04	4
	CRR 615-PR27699-B-D808-4-4	3.9
	Sadabahar (best check)	3
	Mean	2.02
	CD (0.05)	0.57
	CV (%)	17.1

IR 83641-885-B-B and IR 83617396-B-B yielded 2.5 t/ha.

Development of High-yielding Varieties for Aerobic Adaptation

Advanced Yield Trial (AYT) under Aerobic Condition

The data on grain yield and yield attributes are in Table 10. The maturity duration of genotypes ranged from 102 days to 123 days. The promising genotypes were above 115 days.

OYT under Aerobic Condition, *Rabi* 2009

One hundred and eighty genotypes were evaluated during *rabi* 2009–10 at CRRI, Cuttack. The performance of selected genotypes under aerobic condition is given in Table 11.

Generation Advance, Selection and Evaluation of Segregating Population of Aerobic Rice

Two different sets of materials (advanced and segregating) were imported from the IRRI. Advanced genotypes were directly evaluated at CRRI, Cuttack in different trials. Two hundred and three segregating populations (F_3 and F_4) from 29 crosses were selected. Two sets of new materials were generated. One was evaluated in AYT and the other in OYT during *kharif* and *rabi* 2009.

One hundred and eighty promising genotypes for aerobic condition were identified. Thirty promising genotypes were selected for AWD. Besides, 239 breeding populations were imported from IRRI. Selections were practiced from the above population and 670 promising single main panicle were identified, selected and again evaluated in *kharif* 2009. Also, 240 bulks made during *rabi* 2009 were evaluated in *kharif* 2009.

Nomination for National Testing

The entries nominated in AICRIP trials is given in Table 12.

Development of High-yielding Varieties for Alternate Wetting and Drying

AYT under AWD Condition, Kharif *2009:* The estimates of mean for yield and yield contributing characters of rice genotypes are in Table 13. Though these genotypes matured from 90 days (IR 84898-B-168-15-1-1) to 120 days (Apo), the maturity duration of most genotypes was above 105 days.

OYT under AWD Condition, Kharif *2009:* One hundred and seventytwo test genotypes with five checks were evaluated during *kharif* 2009. The results of the top five are in Table 14.

AYT under AWD Condition, Rabi *2009:* The estimates

Table 9. Promising entries under IVT-IME, *kharif* 2009.

Promising entry	Yield (t/ha)
IVT-IME (control)	
RDN 98-2-3-5-14	7.1
CR 2642-52	7
RR 272-607	6.6
Abhishek (best check)	6.2
Mean	4.7
CD (0.05)	0.6
CV (%)	6.6
IVT-IME (stress)	
CR 2642-52	3.1
RNSK 1088-7-3-1	2.7
R 1570-2644-2-1547	2.6
Abhishek (best check)	2.4
Mean	1.1
CD (0.05)	0.4
CV (%)	18.7

Table 10. AYT under aerobic condition, *rabi* 2009.

Entries	Plant height (cm)	EBT	Days to maturity	Yield (t/ha)
IR 84887-B-157-38-1	114	12	108	5.2
IR 84898-B-171-32-1	119	12	115	5.2
IR 83922-B-173-2-1	114.4	13	115	5.2
IR 84899-B-185-16-1	113.6	14	115	5.3
IR 83927-B-278-5-1	115.8	13	120	5.3
Annada	91.7	9	110	3.9
Naveen	106.5	11	121	4.7
Lalat	101.9	12	119	4.3
CV (%)	6.2	9.5	0.6	10.4
LSD (P=0.05)	0.39	0.46	2.45	0.79

of mean for yield and yield contributing characters of the top five rice genotypes are in Table 15. The DFF ranged from 76 days to 91 days. The promising genotypes yielded more than the checks.

OYT under AWD Condition, Rabi *2009:* The data on the top five entries are given in Table 16. Eightyeight genotypes with five checks were evaluated during *rabi* 2009–10.

Seventysix promising single plant progenies of crosses (F_6 generation) with special emphasis on drought tolerance were selected during 2009-2010. The promising plants were selected on the basis of high number of panicles / plant, fertility percentage, dwarf plant height, desirable plant type along with yield under stress conditions.

Among the promising derivatives of F_7 generation, three elite lines with high grain yield (3 t / ha under stress and more than 5 t / ha under irrigated conditions), namely, CR 2731-8-5-1-2-1 (IR / Apo), CR 2732-2-2-1-2-1 (CR 143-2-2 / Naveen) and CR 2733-22-7-1-2-1 (Naveen / Cr 143-2-2) were nominated to

Table 11. OYT under aerobic condition, *rabi* 2009.

Entries	Plant height (cm)	EBT	Days to maturity	Yield (t/ha)
IR 84898-B-170-11-1	106	9	115	5.6
IR 84898-B-165-4-1	116.4	10	118	5.1
IR 84900-B-148-7-1	100	8	112	4.9
IR 84898-B-171-14-1	102.2	9	115	4.9
IR 84899-B-179-11-1	102.6	8	120	4.8
Khandagiri	82	8	110	3.4
Annada	84	9	112	3.8
Naveen	108	12	122	3.9

Table 12. Entries nominated in AICRIP trials during 2009.

Trial	CR Number	Designation	Yield (t/ha)
IVT-E Aero	CR 2698-121-5-1-3-1	IR 84895-B-CRA-121-5-1-3-1	5.2
IVT-E Aero	CR 2699-291-4-1-2-1	IR 93922-B-CRA-291-4-1-2-1	5
IVT-IME-Aero	CR 2696-103-14-1-1	IR 83920-B-B-CRA-103-14-1-1-1	5.3
IVT-IME-Aero	CR 2697-277-2-3-2-1	IR 84880-B- CRA-277-2-3-2-1	5.1
IVT-VE-Irrigated	CR 2701-120-46-1-3-1	IR 84882-B-CRA-120-46-1-3-1	6.2
IVT-VE-Irrigated	CR 2704-127-28-1-2-2	IR 839929-B-B-CRA-127-28-1-2-2	5.2
IVT-E-Irrigated	CR 2702-164-17-1-1-5-1	IR 84896-CRA-164-17-1-1-5-1	6
IVT –E-Irrigated	CR 2703-125-22-1-2-1	IR 84882-B-CRA-125-22-1-2-1	5.1

OYT of ICAR/IRRI-CRRI Drought Breeding Network (DBN) for multilocation testing (Table 17).

Hybridization, Generation, Selection and Evaluation of Breeding Materials for Rainfed Semi-aerobic/favourable Uplands

Hybridization, Selection and Evaluation of Segregating Populations: Thirtyfour new cross combinations were made with irrigated varieties IR 64, IR 36, MTU 1010 and BPT 5204 and upland adapted/aerobic varieties developed at IRRI or national programme (ARB 7, Tripuradhan, Sukhawan Apo and Salumpikit). Segregating populations of different generations were evaluated and selections were made based on maturity duration, plant height, panicle length, number of grains/panicle, sterility percentage and disease and pest reaction. Six hundred and thirty single plant selections were made from 15 F_2 populations. One hundred and fourteen progenies from 10 crosses in F_3 generation, 76 progenies from three crosses in F_4 generation, 64 progenies from five crosses in F_5 generation and 79 lines in F_6 generations from 10 crosses were selected for further evaluation. In PYT for bunded uplands, CRR 389-9-2 (3.7 t/ha), CRR 272-29-1 (3.5 t/ha) and CRR 389-9-1 (3.5 t/ha) significantly outyielded the check variety IR 64 (2.7 t/ha).

Table 13. AYT under AWD, *kharif* 2009.

Entries	Plant height (cm)	EBT	Days to maturity	Yield (t/ha)
IR 84880-B-103-14-1-1	133	7	110	5.2
IR 84899-B-184-19-1-1	117	11	104	5.2
IR 83920-B-B-277-2-1-1	119	9	105	5
IR 84899-B-185-16-1-1	124	7	103	4.7
IR 84895-B-127-28-1	122	8	110	4.6
Annada	100	9	110	3.4
Naveen	115	9	119	3.7
Apo	111	9	120	3.1
CV	5.2	10.3	4.9	4.5
LSD (P=0.05)[1]	2.71	0.39	2.46	0.74

DRR Coordinated Trial (AICRIP)

In AVT1E-Aerob only two entries, CR 2623-IR 55419-04 (4 t/ha) and CRR 615-PR27699-B-D808-4-4 (3.9 t/ha) yielded more than the best check, Sadabahar (3 t/ha). The IVT-IME trial was conducted under both irrigated control and rainfed stress conditions.

Table 14. OYT under AWD condition, *kharif* 2009.

Entries	Plant height (cm)	Test weight (g)	Days to maturity	Yield (t/ha)
IR 84887-B-155-40-1-1	128	26.5	123	6.5
IR 84899-B-183-19-1-1	122	24	123	5.2
IR 84899-B-185-22-1-1	121	25.5	120	5
IR 84899-B-B4-1-1	125	25.5	121	4.7
IR 84898-B-168-24-1-1	126	25	123	4.6
Apo	107	23	123	3.2
Sahbhagi Dhan	93	20.5	114	3.5
Annada	91	23.5	112	3.3

Table 15. AYT under AWD condition, *rabi* 2009.

Entries	Plant height (cm)	EBT	Days to maturity	Yield (t/ha)
IR 84880-B-103-14-1	117.6	17	120	5.7
IR 84887-B-156-17-1	120	19	106	5.6
IR 83922-B-173-2-1	114.4	14	115	5.5
IR 84895-B-127-28-1	100.4	13	110	5.2
IR 84899-B-185-16-1	113.6	14	120	5.2
Annada	89.2	10	115	3.2
Naveen	108.8	15	120	4.2
Lalat	104.2	14	122	4.3
CV	4.2	9.2	0.60	11.9
LSD	15.9	1.95	2.13	0.75

Under control conditions RDN 98-2-3-5-14 (7.1 t/ha) and CR 2642-52 (7 t/ha) were the top-yielding entries, significantly out-yielding the best check, Abhishek (6.2 t/ha). Under rainfed very severe stress condition, CR 2642-52 (3.1 t/ha), RNSK-1088-7-3-1 (2.8 t/ha) and R 1570-2644-2-1547 (2.6 t/ha) were the better entries yielding more than 2.5 t/ha. CR 2642-52 was identified as the most promising entry combining very high yield potential with reproductive stage drought tolerance.

Varietal Improvement for Shallow Favourable Lowland and Irrigated Ecosystem

Development of Varieties for Different Seasons with Wider Adaptability

Variety Released: Semi-dwarf, non-lodging, CR Dhan 601 (CRG 1190-1; IET 18558) developed from Jaya / IR 64 yields 5.5 to 7.2 t/ha in 160 days. It is promising for *boro* areas of Orissa, West Bengal and Assam. It is resistant to leaf blast and RTV and moderately resistant to brown spot and sheath rot. It is tolerant to YSB, GLH and LF. The grains are medium slender with intermediate amylose of 23.9% with HRR of 72%.

Dwarf, semi-tall CR Boro Dhan 2 (CR 898; IET 17612) developed through gamma irradiation from China 45 was identified as promising for *boro* areas of Assam and Orissa. It yields 6 t/ha in 150 days. CR Boro Dhan 2 is resistant / moderately resistant to blast, resistant to BLB and tolerant to sheath blight. It is tolerant to YSB. The grains are medium-slender with alkali value of 5.8, amylose content of 23.92% and HRR of 66%.

In irrigated ecology, 60 promising varieties of different maturity durations were evaluated and maintained for hybridization.

Seven high-yielding and highly adaptable genotypes namely Ratna, Lalat, Khandagiri, Vijeta, RR 388-5, Pusa 44 and Swarna-*Sub1* were crossed in a diallel mating design without reciprocals.

One hundred and thirtynine plants with good plant type and yielding ability were selected from the segregating generations of 10 crosses involving elite genotypes Tapaswini, WITA 12, Naveen, Khandagiri, Satabdi, Swarna and Pusa 44.

In shallow favourable lowlands generation

Table 16. OYT under AWD condition, *rabi* 2009.

Entries	Plant height (cm)	EBT	Days to maturity	Yield (t/ha)
IR 84898-B-168-15-1	113.6	13	85	6.2
IR 84899-B-184-18-1	111	12	90	6.1
IR 84895-B-127-20-1	111	15	83	6.1
IR 83928-B-B-295-2-1	104.6	13	88	6.1
IR 83867-B-B-250-3-1	104.8	14	90	6
Annada	92.8	10	84	4.7
Naveen	108.8	12	90	5
Lalat	102.2	14	93	5.3

Table 17. List of cross combination and respective selections during 2009–10.

Cross combinations	Number of selections
Salumpikit x Naveen	7
Salumpikit x Swarna	3
Salumpikit x Apo	3
Salumpikit x Dandi	1
Naveen x Vandana	-
Naveen x CR 143-2-2	17
Naveen x Apo	1
Naveen x Salumpikit	6
CR 143-2-2 x IR 20	2
CR 143-2-2 x Swarna	5
CR 143-2-2 x Apo	2
CR 143-2-2 x Naveen	3
IR 20 x Apo	4
IR 20 x Dandi	17
Dandi x Apo	5

advancement of 365 plant progenies belonging to 35 cross combinations in different generations were made, 534 single plants selected and 46 lines were bulked based upon uniformity, grain yield and plant type.

Ten new cross combinations were attempted with pigmented donor Shyamali and elite high-yielding varieties.

In a station trial 20 advanced cultures were evaluated in a replicated trial along with three checks (Swarna, Pooja and Gayatri).

Genotypes Swarna/Ratna 175 (CR 2712-175; 5.9 t/ha), Swarna/Ratna 174 (CR 2712-174; 5.7 t/ha), Swarna/Ratna 179 (CR 2712-179; 5.4 t/ha) and Swarna/Gayatri 621(CR 2573-621; 5.8 t/ha) were promising with yield of more than 5.5 t/ha. These were nominated for AICRIP trials.

Development of Varieties with High Nitrogen-use Efficiency

Selection from Segregating Generation: Selection of 219 single plants from F_2 was made during *kharif* with application of 30 kg N and 120 kg N with good phenotypic acceptability, long panicle, more grains/panicle, high tillering, dwarf/semi dwarf height, medium duration and better grain types. The results are given in Table 18.

Screening and Evaluation of Irrigated Genotypes for High N-use Efficiency

Fortyfour popular irrigated genotypes were evaluated @ N 0 t/ha, N 120 t/ha and N 200 t/ha levels of N. The efficient checks were IR 36 and Lalat, and the non-efficient checks were N 22, Vikramarya and Ananga. The results are given in Table 19.

Based on the experiment, Indira, Kshira, Birupa, Gajapati, Gouri, Vikramaya and Tapaswini were good for subsistence farming with minimal N application.

Breeding for Tolerance to Zn Deficiency in Irrigated Rice

Generation Advancement, Selection from Segregating Generation for Yield and Tolerance to Zn Deficiency at Target Environment: Generation advancement was done for F_2 crosses IR 36/Ratna, ADT 43/Ratna, Sasyasree/Ratna, ADT 43/IR 36, Pusa 44/Ratna, IR 36/Lalat, Lalat/Ratna, Divya/IR 36 during *kharif* 2009. The F_3 was field tested under Zn-deficient condition at Chakuli, OUAT, during *rabi* 2009-10. The tolerant checks were IR 36 and Ratna, and susceptible checks Tapaswini and IR 64.

Table 18. Selection of single plants for high N-use efficiency.

Cross combination	Number of single plants selected
ADT 43 / Naveen	7
Lalat / Naveen	10
Tapaswini / Naveen	12
Surendra / Naveen	6
Sasyasree / Naveen	11
Lalat / IR 36	10
Lalat / Vijetha	8
Lalat / Prasad	9
Lalat / Divya	8
Lalat / Tapaswini	12
Tapaswini / Prasad	5
Tapaswini / Sasyasree	6
IR 36 / Prasad	12
IR 36 / Surendra	10
Pusa 44 / Sasyasree	11
Vijetha / Sasyasree	8
Vijetha / ADT 43	7
IR 36 / Lalat	7
Birupa / Vijetha	6
Birupa / Pusa 44	9
Birupa / Divya	7
Birupa / ADT 43	10
Birupa / Surendra	6
ADT 43 / Divya	7
ADT 43 / IR 36	10
ADT 43 / Sasyasree	8

Varietal Improvement for Rainfed Unfavourable Lowlands

Development of Varieties of Medium and Mid-late Duration with Major Biotic and Abiotic Stress Tolerance (Drought)

Hybridization was accomplished and F_1 cross seeds were harvested using Swarna, Savitri, Pooja, Gayatri, Sarala and MTU 1071 as female parents and Aday Sel, Apo, Salumpikit, Kalakeri, CBO13-15 and CR 143-2-2 as male parents.

One hundred and ninety selections (F_5-F_6) were made from 12 crosses. Nineteen promising selections were identified based on various characters. The top five selections were IR 81896-B-B-49 (3.1 t / ha), IR 81896-B-B-435 (2.9 t / ha), IR 81896-B-B-288 (2.4 t / ha), IR 81896-B-B-249 (2.4 t / ha) and IR 81896-B-B-172 (2.4 t / ha).

Development of HYVs of Mid-late to Late Duration for Medium-deepwater Areas

Identification of New Donors Tolerant to Waterlogging: Among the 16 genotypes evaluated in a replicated trial, genotypes AC 42103, AC 42220, AC 42243 and AC 42254 were tolerant to stagnant flooding. These cultivars maintained a greater panicle number / m^2, greater fertile spikelet numbers / panicle and greater panicle weight than susceptible cultivars. Stability index (grain yield under stagnant flooding / grain yield under non-stress condition) was nearer to 1.

Generation, Selection and Advancement of Breeding Material: During *kharif* 2009, 1,112 single plant progenies were selected from 904 segregating progenies and 50 F_2 bulks involving different cross combinations and donors for tolerance to submergence, water stagnation and grain quality on the basis of plant and panicle characters. Fortyfive uniform progenies were also selected from F_7 generation.

Evaluation of Advanced Breeding Lines (Station Trial): Ninety uniform lines selected from F_6 and F_7 were evaluated in OYT along with standard checks (Varshadhan, Sabita, Purnendu, Sarala and Jal-lahari). The top five entries are given in Table 20.

Evaluation of Improved Breeding Lines under Waterlogged and Normal Irrigated Conditions: Ten entries received from IRRI, Philippines along with two checks, Swarna-*Sub1* and Varshadhan were evaluated under normal and stress (stagnant water) condition. The results are given in Table 21.

AICRIP Trials-National Semi-deepwater Screening Nursery (NSDWSN): Fortyone genotypes along with three checks (Sabita, Purnendu and Varshadhan) received from DRR under AICRIP

Table 19. Agronomic N-use efficiency of irrigated rice genotypes in *rabi* 2009-10.

Designation	N 0 (t/ha)	N 120 (t/ha)	N 200 (t/ha)	Agronomic N-use efficiency (kg/kg)	
				N 120 AE_{N1}	N 200 AE_{N2}
CR 2340-3	2.5	6.2	6.3	30.458	18.852
Suraksha	3.2	6.5	7.3	27.262	20.03
Bhavani	2.6	5.7	6.1	25.274	17.34
Pusa 44	2.5	5.6	6.8	25.262	21.19
Surendra	2.8	5.8	7.3	24.858	24.858
Naveen	2.4	5.4	5.9	24.862	17.672
Sravani	2.6	5.6	6.5	24.549	19.527
Indira	4.1	7	8.3	24.46	21.18
Pusa 44	2.5	5.6	6.8	25.3	21.1
Gouri	3.7	4.7	4.9	8.2	5.9
IR 36 (efficient check)	3.1	3.1	7.3	18.6	21.02
Lalat (efficient check)	2.5	4.2	5.5	15.47	14.852
N22 (non-efficient check)	2.3	3.1	2.9	6.137	2.76
Vikramarya (non-efficient check)	3.6	4.2	4.8	5.087	5.685
Ananga (non-efficient check)	3.03	3.7	4.8	5.27	8.645
Mean	3.119	5.047	5.91	16.06	13.97
CV	4.4295	3.0845	3.4412	8.954	8.228
SEM	0.937	0.110	0.143	1.016	0.812
CD 0.05	0.267	0.314	0.410	2.898	2.318

trial NSDWSN were evaluated for yield and other traits. The performance of different entries under NSDWSN is given in Table 22.

Among the different entries, CR 2652-14, CR 2547-62-316, CR 2458-72-2 and CR 2400-12-1 were promoted to IVT-SDW on the basis of overall performance at different centres.

AICRIP Trials-AYT 1 (Semi-deepwater): Nine genotypes along with three checks (Sabita, Purnendu and Varshadhan) received from DRR under AICRIP trial AVT 1-SDW were evaluated for yield and other traits. The performance is given in Table 23.

Development of Varieties for Anaerobic Seeding

Identification of New Germplasm having Tolerance to Anaerobic Seeding: Among 170 genotypes AC 40413 (80%), AC 40602 (75%), AC 41658 (90%), AC 41620 (80%), AC 1303 (70%) and AC 1472 (75%) had higher germination. The height of the seedling @ 15 DAS was 25 cm in AC 41620 followed by AC 40602 (20 cm), AC 1472 (19 cm), AC 40413 (18 cm), AC 1303 (16 cm) and AC 41658 (15 cm).

Table 20. Promising entries under station trial during *kharif* 2009.

Entry	DFF	Plant height (cm)	Panicles / m^2	Yield (t / ha)
CR 2416-13-1-1-1	144	146.2	207	5.9
CR 2378-13-1-1-1	151	170.0	231	5.6
CR 2389-5-2-1-1	141	146.2	177	5.5
CR 2389-11-2-1-1	150	169.4	205	5.4
CR 2378-13-1-1-1	145	130.6	204	5.3
Varshadhan (check)	147	170.7	213	4.3
Sabita (check)	131	166.9	219	4.1
Purnendu (check)	132	176.5	204	3.7
Sarala (check)	132	124.3	201	3.4
Mean	143	155.8	200	3.8
LSD (5%)	8	6.1	85	1.1
CV (%)	5.9	10.5	13.7	18.7

Generation of New Crosses and Advancement of Breeding Material: Eightyseven single plant selections were made from 95 progenies (F_4-F_6) involving 11 cross combinations developed for tolerance to anaerobic seeding on the basis of plant and panicle characters grown under directed seeded condition. Besides, three mapping populations IR 42 / Panikekoa, IR 42 / AC 1631 and IR 42 / EC 516602 were developed to identify new genes for tolerance to anaerobic seeding were generation advanced (F_4 to F_5) during *kharif* 2009.

Development of Suitable Varieties for Delayed Monsoon/Early Flooding

Variety Released: Developed from Savitri / Padmini CR 2008-111 (IET 19189) was identified by the Variety Identification Committee for cultivation in semi-deepwater areas of Uttar Pradesh as a replacement of Jalapriya and in Assam as a replacement of Badal. IET 19189 is 130 to 135 cm tall. It yields 4.5 t / ha in 152 days. It is resistant to neck blast, moderately resistant to leaf blast, and brown spot. The grains are long bold with a HRR of 52%, alkali value of 4.76 and amylose content of 23.1%. It has a flowering duration of 129 days and has long bold grains.

Eighteen advanced cultures were evaluated in a replicated transplanted condition in *kharif* 2009 for yield and yield attributing characters with two checks, Durga and Varshadhan with both normal and aged seedlings. Based on the overall performance CR 2565-549, CR 758-16, CR 874-123, CR 2008-111-4 and CR 2458-77 were nominated for NSDWSN. CR 2458-72 and CR 2547-62-316 were promoted to IVT semi-deep. The results are in Table 24.

Table 21. Performance of entries for yield under normal and stress (stagnant water) conditions.

Entry	Yield (t / ha)		Stability index[1]
	Normal	Stress	
IR 49830-7-1-2-3	1.8	2.7	1.5
IR 66876-11-NDR 1-1-1-1	2.9	3	1.1
IR 67440-M-5-1-1-1-1	3.3	3.1	0.9
IR 70213-10-CPA 4-2-1-1-3	1.3	2.2	1.1
IR 70213-9-CPA 12-UBN-2-1-3-1	2	2.2	1.6
IR 70215-2-CPA 2-1-B-2	1.8	2.3	1.3
IR 70181-32-PM1-1-1-5-1	2.3	2.2	0.9
IRRI 119 (PSBRC 68)	2	3	1.5
IR 70213-10-CPA 4-2-3-2	2	1.5	0.7
IR 67495-M-2-1-1-1-1	2.7	2.9	1.1
Swarna-*Sub1* (check)	2.1	2.5	1.2
Varshadhan (check)	2.5	2.5	1
Mean	2.2	2.5	-
LSD (5%)	0.7	1.1	-
CV (%)	19	25	-

[1]Stability index: Grain yield under stress situation / grain yield under normal situation.

Table 22. Performance of entries in NSDWSN.

Entry	DFF	Plant height (cm)	EBT / m²	Yield (t / ha)	Survival (%)
CR 2683-45-1-2-1	148	197.6	210	3.2	72
CR 2682-7-1-1-1	143	171.1	226	2.9	77
CR 2547-62-316	127	131.7	169	2.7	73
CR 2652-14	134	148.8	234	2.5	72
TTB 303-1-42	143	176.5	225	2.5	73
OR 2404-5	150	159.4	170	2.4	49
CR 2003-2-1	144	148.8	183	2.3	73
Sabita (check)	137	164.1	95	2.3	69
Purnendu (check)	139	186.7	193	1.9	81
Varshadhan (check)	148	184.8	177	2.3	51
Mean	139	161.5	145	1.1	56
LSD (5%)	7	5.0	41	347	-
CV (%)	2.5	1.5	14	15.8	-

Fifteen new cross combinations were attempted involving Varshadhan, Gayatri, Durga and Swarna-*Sub1* for generating new breeding material. Generation advancement of segregating material belonging to 16 cross combinations were made and 265 single plants were selected for further evaluation.

Development of Short-duration Salt-tolerant Variety for Coastal Saline Areas in Dry Season

Variety Released

CR Dhan 402 (CR 2096-71-2; IET 18697): Developed from Mahsuri / Ormumdakan salt-tolerant (5 to 8 dS / m), was released for cultivation by the Orissa State Seed Sub-Committee of Agricultural Crops in the coastal saline areas of Orissa. CR Dhan 402 yields 3.5 t / ha in 150 days and is resistant to blast and moderately resistant to sheath blight and brown spot. It is tolerant to YSB, BPH and LF. The grains are medium slender with HRR of 63%.

CR Dhan 403 (CR 2095-181-1; IET 19470): Developed from Mahsuri / Chakrabanda, CR Dhan 403 was released for cultivation by the Orissa State Seed Sub-Committee of Agricultural Crops in the coastal saline areas of Orissa. It yields 3.6–4.3 t / ha in 140 days. It is resistant to blast and moderately resistant to sheath blight and brown spot. It is tolerant to YSB, BPH and LF. IET 19470 is tolerant to salinity (4.8 dS / m to 7.2 dS / m).

Generation Advancement

Kharif: One thousand three hundred and fortysix selected plant progenies were grown for generation advancement in F_4 generation out of which 578 single plants were selected.

Rabi: A total of 1,121 F_3 progenies of previously-made crosses using Naveen, Annapurna, Anjali, Kalinga III and Chandan as female parents and CSR 10, IR 72046-BR-3-3-1 and FL 478 as salt-tolerant donors were grown for generation advancement out of which 1,346 single plants were selected.

Breeding HYVs for Deepwater Rice

Variety Released

Semi-dwarf, non-lodging CR Dhan 401 (CR 780-1937-1-3; IET 19969) was released by the Orissa State Seed Sub-Committee of Agricultural Crops for shallow lowlands of Orissa. Developed from Savitri / IR 44, it yields 5.4 t / ha in 145 to 150 days. It is resistant to leaf blast and is moderately tolerant to neck blast, brown spot, sheath blight and sheath rot. It is resistant to stem borer and LH and is moderately tolerant to GLH, WBPH, rice thrips and EHB.

Table 23. Performance of entries in AVT-1-SDW.

Entry	DFF	Plant height (cm)	EBT / m²	Yield (t / ha)	Survival (%)
NWGR 266	128	129.7	167	1.6	55
OR 2310-4	137	124.6	184	2.3(1)	64
TTB 300-18-3	137	159.1	200	2	54
CN 1448-4-3-2	115	143.3	141	0.7	64
OR 2164-1	126	136.7	187	1.4	54
CR 2501-16-1	137	150.3	185	2.1(2)	63
CR 2286-4-1-1-2	136	165.6	130	2.1(3)	72
NDGR 201	136	180.1	223	1.9	70
OR 2315-6	140	145.1	122	1.3	69
Sabita (check)	129	123.8	169	1.4	42
Purnendu (check)	128	140.8	170	1.6	58
Varshadhan (check)	150	171.6	128	1.7	59
Mean	134	147.6	167	1.7	60
LSD (5%)	4	13.5	35	415	-
CV (%)	1.6	5.4	12.5	14.2	-

The grains are medium slender with amylose of 22.34% at HRR of 62%.

Promising Culture

Developed from Ravana/Mahsuri, IET 20220 (CR 2285-6-6-3-1) is promising for deepwater in Orissa and Uttar Pradesh. It yields 3.5-4 t/ha in 170 days. It has good kneeing ability, elongation with good phenotypic acceptability.

Selection and Evaluation of Ongoing Segregating Materials

During *kharif*, 2009, the segregating materials were in F_2, F_3, F_4, F_5 and F_6. Selections were practiced within the segregating population of a cross combination in F_2 generation. Out of two thousand plant populations 200 promising single plants were selected.

Two hundred and thirtyfive superior progenies from the F_3 segregating generation were made from the F_3 pedigree nursery for advancement to F_4.

Semi-dwarf and non-lodging CR Dhan 401 was released for cultivation in shallow lowlands of Orissa.

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In the F_4 population, 270 promising single plants were selected and in F_5 76 promising single plants were selected in the pedigree nursery. In *kharif*, 2009, uniform plant progenies of 35 F_6 lines were bulked and 25 single plant selections were made for further evaluation and advancement.

Station trial comprised of 24 fixed lines and three checks in RBD with two replications. The performance of the promising entries is given in the Table 25.

Breeding for Flood-prone Ecologies

Development of Pre-flood *Ahu* Rice

During *ahu* 2009, 14 early maturing rice varieties were evaluated for suitability as pre-flood *ahu* crop (Table). Rice Nilagiri (3.5 t/ha) gave significantly higher yield followed by Kalong (3.2 t/ha) with similar crop duration. The local check Luit gave 2.5 t/ha.

Evaluation of Genotypes for Post-flood *Sali*

Fifteen varieties of early, photoperiod insensitive and long duration photoperiod sensitive rice were evaluated for post-flood s*ali*. Rice Kalong yielded 4.3 t/ha with DFF of 71 days followed by Nilagiri (3.9 t/ha; DFF 73 days).

AICRIP Trials

During *kharif* 2009, trials IVT-VE, AVT-1 SDW and NSDWSN were conducted.

In IVT-VE, CR 2706 (3.3 t/ha) gave the highest grain yield.

In AVT 1 SDW, OR 2310-4 (4.5 t/ha) gave the highest yield.

In NSDWSN, CR 2652-14 (5 t/ha) gave the highest yield.

Evaluation of Rice Varieties for Flash-flood

Out of 18 semi-deep and deepwater rice varieties tested for tolerance to flash flood, Jalpriya (3.5 t/ha) gave the highest yield. Although, the crop was not affected by flood, there was waterlogging.

Table 24. Performance of promising cultures under delayed seeding and planting with aged seedling.

Culture	DFF mean	Plant height (cm)		Yield (t/ha)	
		Delayed seeding	Aged seedling	Delayed seeding	Aged seedling
CR 683-12	146	157	161.1	3.7	3.2
CR 758-16	142	147.3	143.8	4.2	3.9
CR 874-123	144	184	182.1	4.3	2.8
CR 2565 -549	146	128.4	122.9	4.6	3.7
CR 2459-12	132	115.1	110.1	4.8	3.5
CR 2458-77	139	125.2	120.1	4.1	4.5
CR 2683-45-1-3-1	136	163.8	156.6	3.7	3.6
CR 2683-10-9-2	135	155.8	146.1	4	3.9
IR 49830-7	127.5	107.3	100.1	3.3	3.4
CR 2389-13-2-1-1	141	137.7	135.7	4.2	4
Varshadhan (check)	138	170.2	164.6	3.5	4.1
Durga (check)	137.5	152.9	140.9	3.6	4

Table 25. Performance of entries in station trial, *kharif* 2009.

Entry	Cross combination	DFF	Plant height (cm)	Yield (t/ha)	Grain type
CR 2683-28-45-1-5	CRLC 899/EC 491357	135	152	4	S
CR 2695-10-1-2-3	RD 19/Jalmagna/EC 491357	136	140	4.1	B
CR 2304-12-9-7-4	RD 19/Hanseswari	136	155	4	MS
CR 2611-3-2-2-1	RD 19/Durga	137	142	4	MS
CR 2304-5-3-7-1	RD 19/Hanseswari	137	145	4.2	MS
CR 2241-7-2-3-1	Ambika/Chakaakhi	134	151	4.3	MS
CR 2304-5-3-7-1	RD 19/Hanseswari	136	146	4.2	MS
CR 2687-4-13-2-1	CRLC 899/Warda2	136	155	4.3	MS
CR 2681-23-3-1-2	Gayatri/Warda2	136	132	4.4	MS
CR 2682-4-2-2-2-1	CRL C899/EC 491363	135	154	4	MS
CR 2683-16-4-3-2-1	CRL C899/EC 491457	137	152	4.4	MS
CR 2681-23-3-1-1	Gayatri/Warda2	133	137	4.1	MS
CR 2330-3-3-2-1-1	CR 758-16/Jitendra	133	164	4	MS
CR 2304-5-7-2-2-1	RD 19/Hanseswari	135	156	4.3	MS
Jalmagna (check)	-	137	162	3.4	SB
Dinesh (check)	-	136	157	3.5	MB
Durga (check)	-	140	155	3.6	MS

Hybrid Rice Technology

Promising Hybrids Identified

Rice hybrid CRHR 5 (IET 19600) developed from CRMS 32A/IR 42266-29-3R through heterosis breeding utilizing CGMS type of male sterility was identified as promising for *boro* areas of Orissa and Assam. CRHR 5 was earlier released as Rajalaxmi in 2005 for irrigated and shallow lowlands in Orissa. Medium-tall CRHR 5 with an erect, non-lodging plant type yields 5 to 5.5 t/ha in 150 days. The grains are long slender with amylose content of 24.96%, alkali value of 5 and HRR of 62%.

Developed from CRMS 31A/CRL22 through heterosis breeding, CR Dhan 701 (CRHR 32; IET 20852) was promising for late-irrigated/shallow water areas of Bihar and Gujarat. Erect, non-lodging, medium-tall CR Dhan 701 yields 4 to 6 t/ha in 140 days. The grains are medium slender with amylose content of 25.61%, alkali value of 5 and HRR of 51.6%.

Production and Evaluation of Test Cross Hybrids

Test crosses were made with six promising CMS lines and pollen parents from different sources. About 580 test cross hybrids were evaluated in *kharif* 2009 and *rabi* 2009-10. About 30 fertile (100-150 days) and 15 sterile F_1s (90-140 days) combinations were identified as promising. The fertile test crosses were repeated

Table 26. Promising test cross combinations identified during 2009.

Cross	Duration	Spikelet fertility (%)
CRMS 31A x CP 138-03-24	132	>90
CRMS 31A x HR 24-1269	140	>90
CRMS 32A x HR 24-1274	140	>90
CRMS 32A x HR 22-1444	141	>90
PMS 10A x HR 22-1448	140	>90
CRMS 32A x HR 21-1471	141	>90
CRMS 32A x HR 21-1479	140	>90
CRMS 32A x HR 21-1487	142	>90
CRMS 31A x CRL 34	145	>90
CRMS 31A x CRL 22-8	144	>90
CRMS 32A x CRL 22-8	141	>90
CRMS 32A x CP 138-30	131	>90
CRMS 31A x HR 20-1263-81	142	>90
APMS 6A x HR 33-1210	130	>90
CRMS 32A x HR 33-1210	132	>90
CRMS 31A x CRL 23-7	143	>90
RTN 10A x IR 42266-29-3R	125	>90
CRMS 32A x IR 184-2-1-1100	105	>90
CRMS 32A x IR 79906-B-92-2-1-1993	102	>90

and backcrosses were initiated on the sterile F_1s to develop new CMS lines. Some of the promising fertile test crosses are in Table 26.

Maintenance, Evaluation and Multiplication of CMS Lines

Fifteen CMS lines including five CRRI bred CMS lines and 10 CMS lines from other sources were evaluated for different agro-morphological characteristics and maintained through hand crosses. Seven CMS lines including the long duration line, CRMS 24A were multiplied on field scale in *kharif* 2009 and *rabi* 2009-10 and sufficient quantities of CMS seeds were produced for further use in multiplication of 'A' line and / or for hybrid seed production.

Transfer of Characters into CMS Lines

Transfer of characters into the parental lines was taken up for BLB resistance, stigma exsertion and *eui* gene for better outcrossing. For BLB genes, xa 5, xa 13 and Xa 21, BC_2F_1 hybrids with the recurrent parents, CRMS 31B and CRMS 32B were developed and BC_2F_2 progenies were grown. Crosses were also made between the restorer line, IR 42266-29-3R and the donor for BLB genes (three gene pyramid). BC_1F_1 hybrids were developed.

Exserted Stigma: Transfer of the trait into CRMS 31B and CRMS 32B is in progress (BC_1F_4). Selections were made for the recurrent parent types with exserted stigma. A few crosses were made with exserted stigma segregants on CMS lines, CRMS 31A and CRMS 32A. The F_1s were identified to show maintainer reaction. Backcrosses were initiated to transfer exserted stigma trait into genetic background of CRMS 31A and CRMS 32A.

Pyramiding of *Rf* genes into potential partial restorers for exploitation as restorers was taken up. The partial restorers selected for the purpose of crossing with the restorer, IR 42266-29-3R were Mahalaxmi, Gayatri and PK 06-1. BC_1 hybrids were developed with recurrent parents. The backcross F_1s were tested for presence of RF genes and the second backcross were made with recurrent parents. F_3 progenies of the selections made in F_2 generation were grown.

Status of Backcrossing to Develop New CMS Lines

Fiftyfive backcross progenies (BC_1–BC_7) were evaluated for pollen and spikelet sterility. These were carried forward to develop new CMS lines in WA and Kalinga I backgrounds. Fifteen new backcrosses were initiated during *kharif* 2009. These included crosses with some short duration varieties adapted to aerobic condition with drought tolerance (Table 27).

Seed Production of Hybrids

Hybrid seeds of 22 combinations (14 long duration) including that of the two released hybrids Ajay and Rajalaxmi were produced for conducting different trials.

Five long duration hybrid combinations were nominated for evaluation in SLHRT-2009 at six locations during *kharif* 2009. Flowering synchronization studies of the parental lines of the long duration hybrids, CRHR 32, CRHR 33, CRHR 42, CRHR 43 and CRHR 46 were taken up both during *kharif* and *rabi* to study the synchronization and flowering behaviour of the long duration restorers in *kharif* and *rabi*.

Restorer and Maintainer Breeding

Parental line improvement was taken up through population improvement and recombination breeding (Table 28).

Population Improvement: Five random mating maintainer populations and four restorer populations were grown in *kharif* 2009 in isolated plots and random mating cycles were continued. Selections were made from each of the populations and were grown in pedigree method. Test crosses were made with some of the promising selections to identify maintainers and restorers and a few fertile heterotic combinations and some sterile crosses were identified for developing new hybrids and CMS lines.

Recombination Breeding: About 1,100 single plant selections in F_2-F_7 generation from 39, B x B, R x R and A x R crosses were grown in pedigree nursery. Crosses were made with some of the promising selections from advanced generations of these crosses on CMS lines. Highly heterotic combinations with long, heavy panicles were identified in 125 days to 150 days duration.

Evaluation of Hybrids

National Hybrid Rice Trial—Shallow Lowland Hybrid

Table 27. New backcrosses initiated during *kharif* 2009.

Line under conversion	Pedigree	CMS source	Cytoplasm	Generation
HR 26-157	CRMS 32A / HR 26-157	CRMS 32A	Kalinga I	BC_1
HR 28-302	CRMS 31A / HR 28-302	CRMS 31A	WA	BC_1
HR 29-PR-08-169	CRMS 31A / HR 29-PR-08-169	CRMS 31A	WA	BC_1
CR 2234-1693	CRMS 32A / CR 2234-1693	CRMS 32A	Kalinga I	BC_1
IR 71591-923	CRMS 32A / IR 71591-923	CRMS 32A	Kalinga I	BC_1
HR 30-PR08-14	CRMS 31A / HR 30-PR08-14	CRMS 31A	WA	BC_1
Abhishek	CRMS 31A / Abhishek	CRMS 31A	WA	BC_1
CR 2234-1114	CRMS 31A / CR 2234-1114	CRMS 31A	WA	BC_1
Satabdi	CRMS 31A / Satabdi	CRMS 31A	WA	BC_1
Virendra	CRMS 32A / Virendra	CRMS 32A	Kalinga I	BC_1
CR 2234-1112	CRMS 32A / CR 2234-1112	CRMS 32A	Kalinga I	BC_1
HR 31-1062	CRMS 32A / HR 31-1062	CRMS 32A	Kalinga 1	BC_1
IR 74371-70-1-1	CRMS 32A / IR 74371-70-1-1	CRMS 32A	Kalinga I	BC_1
IR 8361-4-178-B	CRMS 31A / IR 8361-4-178-B	CRMS 31A	WA	BC_1

Table 28. Population improvement of restorers and maintainers, *kharif* 2009.

	Number of selections	Generation
Maintainer population		
IR 71590	33	F_2-F_9
IR 71591	22	F_2-F_9
CRMP 1	49	F_8
CRMP 2	25	F_7
CRMP 3	115	F_2
Restorer population		
CP 138	40	F_2-F_9
CP 139	17	F_2-F_9
CRRP 1	49	F_6
CRRP 2	45	F_3

Trial (SLHRT): Five hybrids along with five check varieties were tested at six locations in replicated trials (SLHRT) during *kharif* 2009. Only one hybrid, CRHR 35 showed yield advantage over best inbred check, hybrid check and flowering duration on overall mean basis. CRHR 35 was promoted to AVT-1 (L).

Performance of Hybrids in National Trials and Nomination of Hybrids for National Trials

CRHR 46 (IET 21300) was ranked overall first in AVT-1 (L) and was promoted to AVT-2 (L). It stood first in Chhattisgarh, Bihar, West Bengal and Gujarat.

Non-lodging, medium-tall CRHR 35 (IET 21702) was overall first in SLHRT 2009 and was promoted to AVT-1 (L). It has good grain quality characteristics.

CRHR 5 ranked first in the third year of testing in AL&ISTVT.

Five hybrids (long duration) were nominated for SLHT during *kharif* 2009. Four more hybrids of medium duration were nominated for IHRT (M).

Screening of Parental Lines and Hybrids for Diseases and Insect Resistance

Hybrids CRHR 33, CRHR 35, CRHR 36, CRHR 37, CRHR 39, CRHR 40, CRHR 41, CRHR 43 and CRHR 45 were evaluated for diseases and pests. Only CRHR 45 was resistant against leaf blast. None of the hybrids were resistant against leaf folder. All the hybrids were susceptible to BLB with a SES score of 7 or 9.

Development and Evaluation of Super Rice to Raise Yield Ceiling in Irrigated/Shallow Lowlands

Evaluation of New Plant Type (NPT)/Advance Generation under Shallow Lowland Conditions: Twentyone second generation NPT genotypes were tested for yield, agronomic and other morpho-physiological traits for superiority over checks Naveen, Annada and IR 64. Among these, IR 72164-186-5 (6 t/ha) outyielded all other genotypes including the checks by 24.11%. This was followed by IR 73930-31-3-2-2 (5.9 t/ha) and IR 73933-106-2-1-2-2 (5.2 t/ha).

Development and Evaluation of Superior Plant Types for Deepwater

During *kharif* 2009, 63 F_6 superior single plant progenies of 45 inter sub-specific derivatives with three check varieties were tested for initial yield evaluation. CR 2688-6-1-2-1, CR 2674-33-24-1-1, CR 2675-11-5-3-1, CR 2680-44-10-3-2 and CR 2678-36-10-1-2 were promising in initial yield evaluation trial (Table 29).

Biotechnological Approaches

Transgenic Rice

An attempt was made to develop transgenic incorporating *Cry1 Aabc* gene that can confer resistance to YSB. Highly embryogenic calli derived from Swarna were bombarded with gold particles coated with *Cry1 Aabc* gene construct. Of the 770 calli placed for selection, 150 calli survived.

In another experiment, highly embryogenic calli derived from Gayatri and Swarna were co-cultivated with Agro strain LBA 4404 having pDREB1A and 120 and 150 calli respectively of the genotypes are on pre-regeneration media.

Table 29. Promising entries in initial yield evaluation trial, *kharif* 2009.

Entry	Cross combination	DFF	Yield (t/ha)	Grain type
CR 2688-6-1-2-1	Chakaakhi/EC 491356	132	5.5	B
CR 2674-33-24-1-1	Gayatri/EC 491354	134	5.5	B
CR 2675-11-5-3-1	Gayatri/EC 491464	133	5.4	MS
CR 2680-44-10-3-2	Gayatri/CR 2087-262-1	133	5.4	MS
CR 2678-36-10-1-2	Gayatri/CR 2081-92	134	5.4	MS
Gayatri (check)	-	128	4.3	
Chakaakhi (check)	-	136	4.2	
Varshadhan (check)	-	136	4.4	
CV%			11.3	

Transgenic Pusa Basmati 1 plants found positive for the desired genes *T. chitinase* and *Chi-11* were taken as donor parents and were crossed with Swarna and Gayatri to get F_1 hybrids. Later Swarna and Gayatri were used as recurrent parents for transfer of transgenes into the respective backgrounds. Now with Swarna, BC_4 generation plants are available and with Gayatri, BC_1 plants are available.

Doubled Haploid Breeding

Variety Released: CR Dhan 801 (CRAC 2224-1041; IET 18720): Photosensitive, superfine rice developed through doubled haploid breeding from KRH 2 yields 5 t/ha in *kharif* and 5 to 6 t/ha in *rabi* in 117 days. It was released by the Orissa State Seed Sub-Committee of Agricultural Crops for cultivation in rainfed bunded uplands and irrigated conditions of Orissa. CR Dhan 801 is resistant to leaf blast, moderately resistant to sheath rot, RTV, brown spot and sheath blight. It is resistant to gall midge and LF, and moderately resistant to YSB, WBPH and GLH. The grains are long-slender with amylose content of 20.68%, alkali value of 4 and HRR of 66%.

Evaluation: From the evaluation of the doubled haploids generated from five elite hybrid rice varieties, 33 DH were selected for largescale evaluation. These include four from PHB 71, 11 from PA 6201, four from DRRH 1, seven from KRH 2 and seven from Pusa RH 10.

DH was developed from four elite hybrid rice varieties JKRH 401, JKRH 405, Ajay and Rajalaxmi. The frequency of callus induction and the number of plants regenerated and the ploidy levels of the regenerants is given in Table 30.

Molecular Characterization of Insect Pest Populations

Sixteen YSB populations collected from Khurda district, Balasore district, Kendrapara district and Puri district, were analyzed for genetic similarities using 10-mer random genomic primers (RAPDs). Genetic similarity (Jaccard's coefficient of similarity) among YSB populations varied from 0.24 to 0.651, indicating that wide genetic variation exists between YSB populations. Ranjisura showed lowest genetic similarity with Daispatna YSB population, whereas Teismile showed highest genetic similarity with Dolanagar YSB population.

Cluster analysis classified all the 16 rice YSB populations into two major groups, I and II. Group I was classified into three sub-clusters IA, IB, IC and group II into 2 sub-clusters IIA, IIB.

Identification of Brown Spot Resistant Donors and Elite Germplasm

A total of 1,800 lines comprising of germplasm (729), advanced breeding lines (127), and national coordinated nurseries NSN 1 (220), NSN 2 (473), DSN (75), NHSN (83) and resistant donors (93) were screened against brown spot in the nursery in *kharif* 2009. The disease intensity in nursery was high in susceptible check variety Benibhog with a score of 8 and resistant check Ch 45 with score 3. Among the breeding lines for rainfed uplands, CRR 270-4, CRR 616-B-2-66-2, CRR 451-1-B-2, CRR 455-109, CRR 427-21BL-2 and

Table 30. Frequency of green plant regeneration and ploidy levels in the regenerants in different hybrid rice varieties.

Hybrid	Number of plants regenerated					
	Green	Albino	Total	n	2n	3n, 4n
JKRH 401	192	18	210	118	43	10
JKRH 405	321	28	349	121	81	7
Ajay	237	25	262	133	56	9
Rajalaxmi	42	15	57	27	9	6

CRR 646-IR 79971-B-60-B exhibited resistant reaction at Hazaribag and also across location in the country (Table 31).

Bacterial Blight Resistant Lines

A total of 408 entries of NSN 1 (220), DSN (75), NHSN (83) and BLB differentials (25) were screened for reaction to BLB under transplanted condition in shallow rainfed lowland. The following entries showed resistant reaction at Hazaribag and some of these also showed resistant reaction across the locations in India. CR 2285-6-6-3-1, CR 2242-3-2-1-1, CR 2080-3-2-5-2, CRR 615-PR27699-B-D 808-4-4, CR 2346-16, CR 2620-1, CR 2641-48, CR 2619-2, CRHR 48 and Naveen showed resistant reaction, whereas, TN 1 exhibited susceptible reaction (Table 32).

Table 31. Scores of entries for resistance to brown spot.

Entries	Hazaribag	Severity index[1]
CRR 646-IR79971-B-60-B	2	3.9
CRR 455-109	2	3.1
CRR 616-B-2-66-2	3	3.2
CRR 270-4	4	3.3
CRR 451-1-B-2	3	3.3
CRR 427-21BL-2	3	3.5
Benibhog	8	5.4
CH 45	3	

[1]Across 12 locations.

Identification of QTLs Associated with Drought Tolerance

Development of Mapping Population: To identify the QTLs for drought tolerance two populations of recombinant inbred lines (RILs) are being developed with Kalinga III as susceptible parent and Salumpikit and Moroberekan as donor parents (Kalinga III / Salumpikit and Kalinga III / Moroberekan). About 250 lines and 230 lines in F_5 generation of these two crosses respectively, were generation advanced through single seed descent method.

Upland Rice Shuttle Breeding Network

Cooperators under this network locally selected promising breeding lines

Table 32. Low scoring entries of National Coordinated Nurseries against BLB, Hazaribag *kharif* 2009.

Trials	Designation	Score	Severity index[1]
NSN 1 (220)	CR 2282-1-2-5-1	1	5.5
AVT	CR 2285-6-6-3-1	2	5.6
	CR 2242-3-2-1-1	2	5
	CR 2080-3-2-5-2	0	4.8
	CRR 615-PR 27699-B-D 808-4-4	1	5.7
	CR 2346-16	2	
DSN (75)	CR 2620-1	3	5.9
	CR 2641-48	2	6.1
	CR 2619-2	2	5.6
NHSN (83)	CRHR 48	1	5.1
	TN 1	7	7.1
	Naveen	3	

[1]Across 20 locations.

that were then pooled and advanced to multilocation trials. In AYT conducted during *kharif* 2009, 72 entries including checks Anjali, Vandana and Brown Gora of 80-100 days were evaluated at NPK levels of 20 : 20 : 20 t/ha and 40 : 20 : 20 t/ha under rainfed upland conditions. Entries RR 617-B-47-3, RR 646-B-93-6-B-3, IR 79030-Rewa 1338, RR 617-1 and IR 83934-B-B-247-1-1 performed better in yield than other entries at both fertility levels.

OYT was also evaluated under rainfed upland condition . The promising entries based on yield were RR 517-34-1-1, IR 82589-B-B-2-2, IR 82635-B-B-88-2 and RR 429-1. Considering the performance under managed stress and control conditions, RR 348-6, RR 345-2, CR 143-2-2, Annada, Salumpikit and Black Gora were identified as promising drought tolerant donors.

Drought Breeding Network

A total of 276 entries in two duration ranges (100–120 days and greater than 120 days) contributed by both NARES and IRRI were evaluated in advanced and observational yield trials in *kharif* 2009 at CRRI, Cuttack, CRURRS, Hazaribag, IGKV, Raipur, NDUAT, Faizabad, UAS, Bangalore, TNAU, Coimbatore, BAU, Ranchi and DRR, Hyderabad. Among the breeding lines of 100 to 120 days duration in the trial at Hazaribag, IR 80461-B-7-1 (2.8 t/ha, DFF 87 days), IR 83614-46-B (2.5 t/ha, DFF 84 days), NDR 1119 (2.4 t/ha, DFF 87 days), IR 78908-105-B-2-B (2.2 t/ha, DFF 84 days), and IR 79906-B-5-3-3 (2.2 t/ha, DFF 85 days) yielded more than 2 t/ha under severe stress and more than 5 t/ha under control conditions. These lines combine yield potential at par with the widely grown irrigated varieties and perform much better than popular varieties such as MTU 1010 (2 t/ha, DFF 89 days), IR 64 (1.8 t/ha, DFF 87 days) and IR 36 (1.6 t/ha, DFF 87 days) when there was shortage of water.

OYT with 185 entries was conducted at two levels of control and reproductive-stage stress using an alpha-lattice design. Under stress condition entries, IR 83377-B-B-116-3 (2.8 t/ha, DFF 96 days), IR 83376-B-B-130-1 (2.6, DFF 95 days), IR 83380-B-B-124-3 (2.5 t/ha, DFF 96 days) and IR 83381-B-B-7-1 (2.4 t/ha, DFF 93 days) were promising than the checks MTU 1010 (1.7 t/ha, DFF 92 days), IR 64 (1.6 t/ha, DFF 92 days), and Lalat (1.25 t/ha, DFF 98 days).

Polyploidy and Alien Chromosome Introgression Effects on Reproductive Traits

Ploidy Series in Rice: To estimate effect of ploidy on reproductive characteristics and towards identification of ploidy regulated gene expression, efforts were made to develop a ploidy series in rice. Screening for ploidy level was done in anther-cultured derived populations with rice hybrid JKRH 405 as well as male sterile systems 31 A/B and 32 A/B. A total of 129 plants were tested for ploidy status using flow cytometry (FCM) from leaf tissues. The initial screening led to identification of lX (27 plants), 2X (31 plants), 3X (four plants) and 4X (three plants) from JKRH 405. Complete ploidy series (lX to 41') was also obtained from line 32B.

National (AICRIP) and International (INGER) Trials

AICRIP Trial AVT-1-Early Aerobic

Entry CR 2623-IR 55419-04 (IET 21190), a derivative of cross IR 12979-24-1 (Brown) / UPL RI 5, possessing short bold grain had DFF of 77 days and ranked first (3.6 t/ha). It registered 7.13% superiority over the best check (local) and 22.56 % over Rasi (NC). It had moderate resistance to stem borer.

CR 2634-IR 74371-54-1-1 (IET 21193) with long bold grain type and 81 days was promising with second rank recording grain yield DFF of 3.3 t/ha that was 35.16% higher than the local check and 42.97% over Rasi.

AICRIP Trial IVT Mid-early Aerobic

CR 2696-IR 839-20-B-B-CRA-103-14-1-1-1 (IET 21692) with short bold grain type and DFF 84 days ranked first with mean yield of 4.3 t/ha.

CR 2697-IR 84880-B-CRA-277-2-3-2-1 (IET 21693) stood second with mean grain yield of 4 t/ha.

AICRIP Trial AVT-VE (DS)

Entry CRR 617-B-47-3 (IET 20853) ranked first with mean yield of 3.6 t/ha with DFF of 68 days. It has medium slender grains. It showed yield advantage of

15.57% over national, 5.73% over regional and 1.8% over local check. The local check ranked second in the trial. The other entries did not show superiority over regional and local check.

AICRIP Trial IVT-VE (DS)

Entry JDP 39-1-RR 411-36 (IET 21279) ranked first with mean yield of 4.3 t/ha. It had medium slender grains. RR 347-5 (IET 21288) ranked second (4.1 t/ha) in the trial.

AICRIP Trial AVT 1-E (DS)

Entry Rewa 673-RR 418-185 (IET 21096) ranked first with mean yield of 4.2 t/ha with medium slender grains over the best local check Vandana (3.5 t/ha). VNR 201 (IET 20708) ranked second (4.2 t/ha).

AICRIP Trial IVT-E (DS)

Entry RPHR 516-2-4-5-6-1 (IET 21639) ranked first with mean yield of 5.6 t/ha with medium slender

Table 33. Top entries in AICRIP 2009 trials.

Trials / Number of entries	Best entries	Yield (t/ ha)
Irrigated mid-early		
IVT IME / 64	IET 21592	5.5
	IET 21587	5.4
	IET 21590	5.3
	IR 64 (NC)	3.5
AVT 1 IME / 10	IET 20716	5.1
	PA 6201	4.7
	IET 20727	4.4
	IR 64 (NC)	3.6
AVT 2 IME / 8	IET 20419	5.7
	PA 6201	5.3
	Naveen (LC)	4.4
	IR 64 (NC)	4.1

Table 33. Top entries in AICRIP 2009 trials.

Trials / Number of entries	Best entries	Yield (t/ ha)
Irrigated medium		
IVT IM / 64	IET 21528	5.2
	IET 21532	5.1
	IET 21548	5
	Jaya (NC)	3.9
Late		
IVT L / 49	IET 21470	6.3
	IET 21482	6.1
	IET 21467	5.9
	Savitri (NC)	5.2
AVT 1 L / 20	IET 21300	6.9
	IET 20617	6.2
	IET 19886	6.2
	Savitri (NC)	5.8
AVT 2 L / 12	IET 20852	5.6
	Pooja (RC)	5.4
	IET 20262	5.4
	Savitri (NC)	5.3
Aromatic Short Grain Trials		
IVT ASG / 15	IET 19713	5
	IET 21044	4
	IET 21053	3.9
	Badsabhog (check)	2.3
ASGON / 21	IET 21277	3.5
	IET 21267	3.4
	IET 21264	3.3
	Badsabhog (check)	3.1

Table 34. Performance of entries in deepwater trials, *kharif* 2009.

Entries	Plant height (cm)	DFF	Submergence tolerance	Elongation	Kneeing ability	Phenotypic acceptability	Yield (t/ha)
IET 20214	151	134	5	3	5	3	4.7
IET 20220	146	133	5	3	5	3	4.7
IET 20697	162	136	5	3	5	3	4.3
IET 20706	165	137	5	3	5	5	4.1
Jalmagna (check)	158	135	5	3	5	3	3.3
Dinesh (check)	156	137	5	3	5	3	3.4
Durga (check)	148	140	5	3	3	3	3.5

grains over the best local check Kalinga III (3.4 t/ha). NWGR 4009 (IET 21614) ranked second (5.4 t/ha) in the trial.

Trials for Irrigated Ecology

During *kharif* 2009, nine AICRIP trials were conducted for irrigated ecology. The performance of the cultures in various trials is in Table 33.

The entries in *kharif* 2009 for the deepwater trials were direct seeded. The result is given in Table 34.

Table 35. Performance of top five entries in AICRIP, NSASN.

Entry	Designation	DFF	Plant height (cm)	Grain yield (t/ha)
IET 21644	NDR 9448 (IR73712-68-3-1-2)	90	68	3.4
IET 21643	NDR 8030 (IR77200-216-NDR-9-12)	116	109	3.2
IET 21641	NVSR 6030	74	92	2.8
IET 21648	NDRK 50018	117	112	2.7
IET 21645	NDRK 50015	100	85	2.7
	CSR 13 (alkaline check)	118	89	2.4
	CSR 27 (inland saline check)	115	89	1.6
	CST 7-1 (coastal saline check)	116	112	1.7
	Jaya (yield check)	115	3,715	1.3
	Lunishree (local check)	116	3,716	2.6
LSD 0.05		1.6		0.6
CV%		0.8		17.4

Table 36. Performance of top five entries in ACRIP, CSTVT.

Entry	Designation	DFF	Plant height (cm)	Grain yield (t/ha)
IET 21235	CR 2218-41-2-1	114	115	4.3
IET 21230	CR 2219-44-2	113	120	4.1
IET 20334	CN 1271-5/9	110	109	3.2
IET 21237	CR 2577-1	93	92	3
IET 21229	CR 2216-59-1	109	120	2.6
	CST 7-1 (coastal saline check)	114	100	1.3
	Jaya (yield check)	115	91	1.3
	Lunishree (local check)	116	125	2.2
LSD 0.05		1.4		0.5
CV%		0.8		17.3

Trials for Coastal Ecology

Sixteen NSASN entries received from AICRIP trial were grown in farmer's field at Ambiki of Ersama block. The water EC ranged from 1 to 2 dS/m and soil pH from 5.1 to 6.2. Entry NDR 9448 (IR 73712-68-3-1-2), (IET 21644), yielded the highest of 3.4 t/ha. The results of the top five entries are in Table 35.

AICRIP Trial (Coastal Saline Tolerant Variety Trial)

Thirteen CSTVT entries received from AICRIP trial were grown in farmer's field at Ambiki of Ersama block. The water EC ranged from 1 to 2 dS/m and soil pH from 5.1 to 6.2. Entry CR 2218-41-2-1 (IET 21235) was the top yielder with 4.3 t/ha. The performance of the top five entries is given in Table 36.

Table 37. Performance of long duration entries (Module 1A) in IRSSTN, *kharif* 2009.

Designation	DFF	Plant height (cm)	Tiller number	Spikelet fertility	Yield (t/ha)
IR 68652-3B-30-2	101	63	8.5	94.8	1.9
IR 70023-4B-R-12-2-3-1	92	82.8	8.1	63.2	1.7
IR 50184-3B-18-2B-1	98	54.8	9.7	76.6	1.6
IR 71999-3R-3.2-2-B-1-1	92	62	8	82.5	1.6
IR 71895-3R-9-3-1	92	70.6	7	70.2	1.6
SR 26B (local check)	90	109.5	7.4	92.3	1.8
LSD (5%)	2.94	6.53	0.8	1.89	168.3
CV (%)	2.4	4.4	13	15.2	17.6

Table 38. Performance of short duration entries (Module 2A) in *rabi* 2009-10.

Designation	DFF	Plant height (cm)	Tiller number	Spikelet fertility	Yield (t/ha)
IR 71895-3R-9-3-1	92	74.5	7.8	93.3	1.8
IR 77674-3B-8-2-2-8-3-AJY 4	92	76	6.7	82.3	1.5
IR 72046-B-R-8-3-1-3	92	66.4	6.3	82.6	1.4
IR 77664-B-25-1-2-1-3-12-4-AJY 1	84	65.9	7.5	80.6	1.4
IR 77644-B-9-3-3-2-1-15-2-AJY 4	92	61.9	6.5	76.3	1.2
IR 29 (check)	95	65.3	6.4	17.3	0.7
IR 72046-B-R-3-3-3-1 (check)	84	78	6.7	92.3	1.5
$LSD_{0.05}$	2.3	3.5	0.4		52.7
CV%	0.4	6.6	16.1		17.3

Table 39. Performance of entries in the National Salinity Breeding Network.

Designation	DFF	Plant height (cm)	Tiller number	Spikelet fertility	Yield (t/ha)
TR 2004-029	105	85.6	6.6	57.7	1.1
TR 2000-003	101	79	5.3	50.1	0.4
TR 2003-025	96	71	6.6	73.1	0.9
NDRCP-1	91	101.6	6.6	58.9	0.3
CR 2485-7-3-45-1	108	82.3	8	68.5	0.8
CR 2219-70-1	92	80.3	7.3	58.5	1.4
CSR 2K-255	100	103.3	8	64.3	1.3
CSR RIL-0650	102	77.6	8.3	60.5	0.5
LSD 0.05	2.94	6.53	0.8	1.89	168.3
CV (%)	2.4	4.4	13	15.2	17.6

IRSSTN (International Rice Soil Stress Tolerance Nursery)

Sets of 33 short duration entries (Module 2A) and 38 long duration entries (Module 1A) received from INGER and eight entries from the National Salinity Breeding Network were grown at farmer's field in Ersama block in *kharif* 2009 and *rabi* 2009-10, respectively. In *rabi* the soil ECe at planting was 15.4 dS/m. Water EC during crop growth was 6.5 to 9.2 dS/m and soil $pH_{1:2}$ was 5-6.9. In *kharif* field water EC was 0.7 to 2.5 dS/m and soil $pH_{1:2}$ during crop growth was 5.1 to 6.2. In *rabi* entry IR 71895-3R-9-3-1 (1.8 t/ha) was promising. In *kharif* entry IR 68652-3B-30-2 (1.9 t/ha) was promising.

In the National Salinity Breeding Network trial CR 2219-70-1 (1.4 t/ha) gave the highest yield. The performance of the top five entries is given in Table 39.

Improvement of Grain and Nutritional Quality

Evaluation and Improvement of Yield of Aromatic Varieties

Rice Variety Released

Aromatic CR Dhan 901 (IET 18394 / CR 2580-7) developed through pure line selection from landrace Chinikamini, was released by the Orissa State Seed Sub-Committee for Agricultural Crops, for cultivation in the rainfed shallow lowlands of Orissa. It yields 3.5 t / ha in 150 days. CR Dhan 901 is resistant to sheath rot, RTV and neck blast. It is also resistant to gall midge 5 and is moderately resistant to stem borer. The grains are short bold with HRR of 66.5%, elongation ratio of 2.01, alkali value of 5 and amylose content of 23.9.

Hybridization

Selection of 1,026 single plant progenies in different generations from 58 crosses was carried out. Two hundred and eighteen F_1 plants were harvested from 25 crosses and 20 new crosses were attempted during *kharif* 2009. Fiftytwo promising aromatic, erect, non-lodging, breeding lines from Swarna / Geetanjali and IR 36 / Basmati 370 were evaluated. Fourteen lines with yields of more 4.5 t / ha from Swarna / Geetanjali and 10 lines with yields of 3.5 t / ha from IR 36 / Basmati 370 were advanced for further evaluation.

CRRI Aromatic Breeding Lines in AICRIP Conducted Trials

ASGON to IVT-ASG: CR 2613-1-5-2-7-2 (IET 21271; Ketekijoha / Randhunipagal) yielded 3.4 t / ha in 124

Aromatic CR Dhan 901released for cultivation in the rainfed shallow lowlands of Orissa yields 3.5 t/ha in 150 days.

DCI

Table 40. Yield performance of promising genotypes under organic management.

Genotypes	Aromatic / non-aromatic	DFF	Plant height (cm)	Yield (t / ha)
Geetanjali / Dubraj (61)	Aromatic	104	128	4.7
Swarna / Geetanjali (11)	Aromatic	116	123	4.7
Pusa 44 / Dubraj (13)	Aromatic	113	96	4.5
BPT 5204 / Banskathi (22)	Non-aromatic	119	93	4.4
KDML 105 / Padmini (8)	Aromatic	119	158	4.3
CRM 2203-4 / Dubraj (29)	Aromatic	107	94	4.2
Chinikamini Mutant (M 13)	Aromatic	110	155	4
Ketekijoha Mutant (M 59)	Aromatic	115	133	4
Kalajeera Mutant (M 7)	Aromatic	115	169	4
Randhunipagal / Ketekijoha (2)	Aromatic	117	141	4
Ketekijoha (check)	Aromatic	115	145	4.2
Padmakeshari (check)	Non-aromatic	118	147	3.2
Nua Kalajeera (check)	Aromatic	112	169	3.4
BPT 5204 (check)	Non-aromatic	108	98	4.4
LSD 5%				5.3[1]
CV%				9.3[1]

[1]Analysis was carried out with 32 genotypes including four checks.

days. It stood first in north-western region (R-2) with yield of 5.6 t / ha. The grains of CR 2613-1-5-2-7-2 were medium-slender, translucent with ER of 1.82, intermediate ASV (5) and intermediate amylose (22.61%) with strong scent.

Promoted to IVT-ASG (Third Year): Culture CR 2616-3-3-3 (IET 21044; Dubraj / Pusa 44) ranked third with yield of 3.4 t / ha, with a mean flowering duration of 115 days, plant height of 89 cm and 272 panicle / m^2. This entry was superior to checks Badshahbhog and Kalanamak at many places and ranked second in Karnataka and third in Orissa and Madhya Pradesh. This culture possessed excellent quality attributes such as translucent medium slender grain, high HRR (61%), ER of 1.7, intermediate alkali spreading value and strong scent.

Development and Evaluation of Quality Rices with Improved Yield Potential under Organic Management

A replicated trial was conducted for evaluation of 28 improved genotypes (recombinant and mutants) under organic nutrient management (FYM + Dhaincha) for yield with four checks (Padmakeshari, Nua Kalajeera, BPT 5204 and Ketekijoha) out of which 10 genotypes with improved yield potential of more than 4 t / ha were identified (Table 40).

Breeding for Resistance/tolerance to Biotic, Abiotic and Environmental Stresses

Identification of New Sources of Resistance/Tolerance to Pests and Diseases

WBPH

Sixty rice genotypes were evaluated against WBPH under net-house conditions at CRRI, Cuttack. Rice IR 64 was the WBPH resistant check and TN 1 the susceptible checks. Five accessions AC 111, AC 1066, AC 1073, AC 124, AC 1418 showed resistant reaction with damage score of 1.

Blast

Three thousand one hundred and thirty germplasm collections comprising of NSN 1 (220), NSN 2 (473), NHSN (83), NSN-H (86), DSN (75), virulence monitoring set (25), CRRI collection including HYV (1,875), drought tolerance breeding lines of CRRI (56), Apo/ Swarna derivatives of drought tolerant IR lines (68), scented rice (160) and hybrid rice (9) were screened against blast disease in the UBN during *kharif 2009* and *rabi 2009-10*. The susceptible checks were HR 12 and B 40. The results are in Table 41.

Bacterial Blight

Two thousand one hundred and fiftyseven germplasm collections comprising of NSN 1 (220), NSN 2 (473), NHSN (83), virulence monitoring set (25), NSN-H (86), DSN (75), CRRI collection (722), drought tolerance breeding lines of CRRI (56), Apo/Swarna derivatives of drought tolerant IR lines (68), scented Rice (160), hybrid rice (9), and HYVs (180) were screened against BLB under artificial inoculation in the field during k*harif* 2009. The results are in Table 42.

Sheath blight

NSN-1: Out of 220 entries, nine entries IET 20891, IET 20898, IET 20942, IET 20735, IET 20278, IET 20827, IET 21299, Sabita and Tarori Basmati were tolerant (score 3) to sheath blight.

NSN-H: Out of 86 entries, five entries IET 21368, IET 21379, IET 21382, IET 21380 and HR 12 were tolerant (score 3).

NHSN: Out of 83 entries, eight entries IET 20752, IET 21404, IET 21405, IET 21413, IET 21426, IET 21427, Jaya, and HR 12 were tolerant (score 3).

DSN: Out of 75 entries, seven entries CR 2649-7, CR 2641-40, VLPR 2, CB 06-112, CB 05-169, CB 0015-24 and TNRH 175 were tolerant (score 3).

Hybrid Rice: Out of nine entries, two entries CRHR 36 and CRHR 41 were tolerant (score 3).

RTD

One thousand five hundred and fortyseven rice genotypes from NSN, NHSN and NSN-H were screened under simulated tungro epiphytotic condition for tolerance/ resistance to RTD k*harif* 2009 at CRRI, Cuttack.

NSN 1: From screening of 220 entries (inclusive of 32 checks) only one entry IET 20235 (CN 1447-9-4-7) was tolerant to RTD with score of 1 on SES scale.

NSN 2: Out of 473 entries with 20 checks, three entries IET 21343 (OR 2404-5), IET 21344 (OR 2405-KK-9) and IET 21498 (ORS 332) had tungro tolerant score of 3.

NSNH: From 86 entries, none were tolerant to tungro at Cuttack.

NHSN: From 83 entries, none were tolerant.

Breeding for Resistance to Major Diseases

Bacterial Blight and Blast

Generation, Selection and Advancement of Breeding Material: New crosses made involving HYVs, Geetanjali and Naveen as recurrent parents and

Table 41. New sources of resistance to blast.

Source (number screened)	Score	Resistant lines	Designation
NSN 1 (220)	0-1	26	NWGR 3045, PAU 3419 3-7-1, PAC 85052 (hybrid), OR 2310-4, CN 1448-4-3-2, OR 2164-1, NDR 2084, OR 1924-4, NK 5048 (hybrid), CR 2282-1-2-5-1, CR 2285-6-6-3-1, CR 2242-3-2-1-1, CR 2080-3-2-5-2, IR 64 Sub1, CRR 615-PR527699-B-D808-4-4, CR 2603, CR 2601, CR 2604, CR 2631-IR74371-3-1-1, CRR 617-B-47-3, CRR 616-B-2-66-2, CRR 455-109, CRR 427-21BL-2, CRR 646-IR79971-B-60-B, Rewa 671RR410-388, R 1456-201-3-1-87-1
NSN 2 (473)	0-1	7	CR 2682-7-1-2-1, CR 2683-35-2-1, CR 2679-2-1-1-1, CR 2680-10-2-2-1, SKL 52-35-49-25-31-60, 2K3-337-5-1-1-5, NDR 6271
NHSN (83)	0-1	2	UPHR 3085, R 6304
NSN-H (86)	0-1	4	HPR 2557, VL 7620, UPR 2992-17-3-1, SKAU 292
DSN (75)	0-1	5	CR 2649-7, CR 2619-6, CR 2619-7, CR 2619-8, VL 30685
VMS(25)	0-1	7	Raminad Str. 3, Tetep, Tadukan, Dular, Zenith, *O. minuta*, IR 64
CRRI collections including HYVs (1,875)	0-1	24	IRGC 10624, IRGC 9178, IRGC 6304, IRGC 6400, IRGC 10803, IRGC 40126, IRGC 40149, ARC 12167, ARC 13898, ARC 14115, AC 1013, AC 1029, AC 1133, AC 1260, Savitri, Abhishek, Lunishree, Bindli, IR 64-*Sub1*, Samalei, Tulsi, Naveen, Chandrama, VLD 16
Drought tolerant breeding lines of CRRI (56)	0-1	9	1-1 (APO x P5), 3-7 (CR 143-2-2 x Swarna), 10-5 (CR 143-2-2 x IR 20), 9-3 (CR 143-2-2 x APO), 23-5 (IR 20 x Naveen), 16-1 (Salumpikit x Naveen), 20-4 (CR 143-2-2 x Swarna), 5-5 (CR 143-2-2 x Swarna), 19-4 (CR 143-2-2 x Swarna)
Promising Apo/ Swarna derivatives of drought tolerant IR lines (68)	0-1	18	IR 81896-B-B-10, IR 81896-b-b-195, IR 81896-B-B-149, IR 81896-B-B-147, IR 81896-B-B-92, IR 81896-B-B-158, IR 81896-B-B-444, IR 81896-B-B-435, IR 81896-B-B-236, IR 81896-B-B-355, IR 81896-B-B-74, IR 81896-B-B-335, IR 81896-B-B-179, IR 81896-B-B-394, IR 81896-B-B-49, IR 81896-B-B-365, IR 81896-B-B-37, IR 81896-B-B-246,
Hybrid rice	0-1	1	CRHR 45
Check	9		HR 12
Check	9		B 40

Table 42. New sources of resistance to BLB.

Source (number screened)	Score	Resistant lines	Designation
NSN 1 (220)	0-3	25	NK 6401 (hybrid), OR 1924-4, NK 5048 (hybrid), CR 2539-1 (Swarna-*Sub1*), UPR 2962-6-2-1, RH 1422, US 382, PAU 201, CR 2496-24-5, CR 2496-50, R 1836-RF-39, improved Sambha Mahsuri, Ajay, R 1238-692-820-1-1, RP 4677-16-6-1-2-2-1, CRMAS 2621-12-9, CRMAS 2621-7-1, PR 113, CRMAS 2622-43-5, CRMAS 2622-7-6, Savitri, Pooja, Rewa 671RR410-1388, CB 001524, IRBB 60
NSN 2 (473)	0-3	36	NPG 412, RAU 631-9-10, CR 2090-6-1-1-1, CR 2677-10-2-3-1, NDR 40150, OR 2327-18, OR 2404-5, CR 2652-14, CR 2680-10-2-5-2, CR 2683-45-1-3-1, TRC 05-8-4-42-8-3-7, PAU 3105-45-3-2, NDR 370134, NP 5151, OR 2329-20, WR 15-6-1, OR 1889-5, CR 2496, R 1532-1238-1099-1, CR 661-236-1-3, CR 2216-59-1, CR 2459-9-1-1, CR 2472-3-27-2, CR 2473-7-169-1, R 1532-1238-1099-1, CR 2216-59-1, CR 2459-9-1-1, CR 2472-3-27-2, CR 2473-7-169-1, OR 2404-KK-11, NDR 1135, 2K3-429-396-2-71-1-21-1-2-0, 2K3-429-396-2-71-1-21-1-7-0, 2K3-430-144-8-17-1-1-3-0, 2K3-430-144-8-56-5-1-15-0, 2K3-430-144-8-32-3-78-2-2-0
NHSN (83)	0-3	09	2RH1531, NK6355, US332, 27P31, VNR 203, US 334, US 336, US 310, ANS 2423
VMS (25)	0-3	13	IRBB 7, IRBB 8, IRBB 11, IRBB 13, IRBB 21, IRBB 60, IRBB 51, IRBB 52, IRBB 53, IRBB 54, IRBB 55, IRBB 56, IRBB 60
NSN-H (86)	0-3	03	SKAU 353, HPR 2529-4, UPR 2992-17-3-1
DSN (75)	0-3	02	VL 30424, CB 06-563
CRRI collections (722)	0-3	01	IRGC 40272
HYV (180)	0-3	08	Swarna-*Sub1*, Sambha Mahsuri, TB 1, Khitish, Pratap, Manik, Surendra, Pratikhya
Drought tolerant lines of CRRI (56)			None were resistant or tolerant
Apo-Swarna derivatives of drought tolerant IT lines(68)			None were resistant or tolerant
Scented rice(160)			None were resistant or tolerant
Hybrid rice(9)			None were resistant or tolerant
Check	9		TN 1
Check	9		Tapaswini

Table 43. New crosses for BLB and blast.

F_2 bulks	Cross combination	Gene combination
1	CRMAS 2232-85 / RIL10	*xa5, xa13 and Xa21 + Pi-12*
2	CRMAS 2232-85 / RIL29	*xa5, xa13 and Xa21 + Pi-7*
3	CRMAS 2232-85 / RIL249	*xa5, xa13 and Xa21 + Pi-5*
4	CRMAS 2232-85 / C101A51	*xa5, xa13 and Xa21 + Pi-2*
5	Geetanjali / CRMAS 2232-85	*xa5, xa13 and Xa21*
6	Geetanjali / IRBB 60	*xa5, xa13 and Xa21*
7	Naveen / CRMAS 2231-48	*xa5, xa13 and Xa21*
8	Naveen / CRMAS 2232-85	*xa5, xa13 and Xa21*
9	Naveen / IRBB 60	*xa5, xa13 and Xa21*

CRMAS 2231-48, CRMAS 2232-85 and IRBB 60 as donors for bacterial blight and C101A51, RIL 10, RIL 29, RIL 45 and RIL 249 as donor for blast resistance were generation advanced during *kharif 2009 and rabi* 2009-10. Details of cross combinations are in Table 43.

Evaluation of Advanced Breeding Lines for Grain Yield and BLB Resistance: Twentyfive promising lines selected on the basis of tolerance to BLB and yield from the last year's OYT were evaluated for grain yield and other traits in a replicated trial under transplanted condition along with five standard checks (Tapaswini, Durga, Gayatri, Sarala and IRBB 60). On the basis of resistance to BLB 15 genotypes were nominated for disease screening under DSN (AICRIP) testing. The results are in Table 44.

AICRIP Trial: AVT 2-NIL-BLB

Four NILs along with three parents Lalat, Tapaswini and IRBB 60 and a local check Surendra received from DRR were evaluated for grain yield and other traits along with resistance to BLB. All four NIL's showed moderate level of resistance to bacterial blight. The results are in Table 45.

Rice Tungro Disease

Fourteen fixed cultures, six segregating populations and two mapping populations (Tapaswini / IET 16952 and TN 1 / IET 16952) were screened against RTD under simulated tungro epiphytotic conditions. Four fixed cultures CR 2654-17, CR 2652-14, CR 2647-5 and CR 2651-13 were highly resistant. One hundred and twentyeight resistant plants from the segregating generations of six crosses Swarna / LPR 106-19, Swarna / AC 290, Naveen / AC 6078, Naveen / LPR 106-19, Gayatri / AC 290 and Gayatri / AC 6078 were selected. New crosses were made involving elite varieties Tapaswini, Satabdi and tungro resistant donors CB 98002, IET 16952 and IC 516210.

CR 2649-7 (IET 21589) from Udaya x IET 16611 stood first in Region III (eastern) in IVT-IME, *kharif* 2009 of AICRIP. It yielded 5.3 t / ha. The increase in yield was 21.6% over the national check, 10.8% over regional check and 10.8% over the local check. Location-wise, it ranked first at Rewa (4.5 t / ha), second at Chinsurah (6.8 t / ha) and third at Raipur (6.2 t / ha) and Chiplima (4.3 t / ha). It ranked first in yield in Madhya Pradesh (36.4%) and second at Orissa (9.4%) and West Bengal (10.8%) over the best varietal checks. Based on the performance in region III it was promoted to AVT 1-IME.

CR 2652-14 (IET 21346) from Sarala x CR 682- 165-1 was promoted to IVT-SDW from NSDWSN, *kharif* 2009 of AICRIP based on the adaptability parameters in semi-deep water situation.

Table 44. Performance of entries nominated for disease screening nursery (DSN) under AICRIP during 2009.

Designation	Score (SES)	DFF	Plant height (cm)	EBT / m^2	Grain yield (t / ha)
CR 2430-11	3	133	133.7	227	5.3
CR 2421-8	5	102	122.1	224	5
CR 2450-5	5	132	162.1	229	4.8
CR 2421-1	5	102	114.4	210	4.5
CR 2421-28	3	102	113.7	205	4.4
CR 2430-10	3	132	120.5	223	4.3
CR 2428-9	5	120	133.9	229	4.2
CR 2421-9	3	99	106.4	216	3.9
CR 2450-12	3	131	137.1	210	3.6
CR 2427-26	3	112	125.3	208	3.5
CR 2450-2	3	128	161.9	198	3.1
CR 2428-6	3	120	122.5	210	2.9
CR 2427-31	3	126	116.3	186	2.7
CR 2428-14	5	118	124.9	195	2.7
CR 2429-5	5	127	150.1	186	2.4
Tapaswini (check)	7	114	126.9	226	4.4
Durga (check)	7	136	167.1	218	4.1
Gayatri (check)	7	129	144.2	222	4
Mean	-	118	132.5	210	3.7
LSD (5%)	-	2	2.2	18	855
CV (%)	-	1.0	1.0	5.3	14.1

Cultures CR 2643-1-4-3-1 (Tapaswini / Vikramarya) and CR 2644-2-6-4-3-2 (Tapaswini / IET 16611) were nominated for IVT-IME 2010 of AICRIP.

CR 2653-16-5-3-4-2 (Pooja / IET 16952) and CR 2654-17-3-2-2 (Pooja / CR 682-165-1) were nominated for NSDWSN, 2010 of AICRIP.

Breeding for Tolerance to Major Abiotic Stresses

Submergence Tolerance

Screening for Submergence Tolerance: Two hundred and seventyfive germplasm lines including both susceptible and tolerant checks namely, Gayatri, IR 42, Swarna, IR 64, Sabita, FR 13A, IR 64-*Sub1* and Swarna-*Sub1* were tested for submergence tolerance under di-

Table 45. Performance of entries in AVT 2-NIL-BLB during *kharif* 2009 at CRRI, Cuttack.

Designation	Score (SES)	Days to maturity	Panicles / m^{-2}	Yield (t / ha)
CRMAS 2621-12-9	7	120	324	3
CRMAS 2621-7-1	5	123	330	3.1
CRMAS 2622-43-5	5	124	293	3.5
CRMAS 2622-7-6	7	123	295	3.6
Lalat (check)	7	120	335	3.4
Tapaswini (check)	7	121	354	3
IRBB 60 (check)	5	123	325	3.8
Surendra (local check)	7	113	373	2.3
Mean		121	329	3.2
LSD (5%)		2	23	347
CV (%)		1.1	4.1	6.1

rect seeding conditions. Twentyone-days-old seedlings were submerged under 120 cm of water depth for 15 days. After 10 days of de-submergence survival count was taken. The entries that were tolerant to complete submergence were AC 443, AC 447, AC 1167, AC 1151, AC 40346, AC 40388, AC 40408 and AC 41642.

Generation, Selection and Advancement of Breeding Material: Two hundred and sixtyeight single plant

Table 46. Performance of entries in AVT 2-NIL-Submergence under submergence conditions.

Designation	Elongation (%)	Survival (%)	DFF	Plant height (cm)	Yield (t / ha)
Swarna-*Sub1*	42	80	134	103.1	4.8
IR 64-*Sub1*	68	84	112	99.9	2.9
Sambha Mahsuri-*Sub1*	46	81	133	105.1	3.5
IR 64	91	29	111	100.3	2
Swarna	75	26	135	97.2	3.9
Sambha Mahsuri	87	27	140	94.8	2.4
Satabdi (check)	89	14	105	102.7	0.8
Pratikshya (check)	77	10	141	100.5	1.4
Mean	72	44	126	100.4	2
LSD (5%)	-	-	3	4.9	608
CV (%)	-	-	1.8	2.8	17.7

Table 47. Performance of entries in AVT 2-NIL-sub-mergence under normal conditions.

Designation	DFF	Plant height (cm)	Yield (t/ha)
Swarna-*Sub1*	123	101.3	4.9
IR 64-*Sub1*	97	97.1	2.9
Sambha Mahsuri-*Sub1*	119	105.1	2.9
IR 64	98	95.5	2.3
Swarna	121	105.4	4.8
Sambha Mahsuri	118	102.2	2.8
Satabdi (check)	87	106.9	3.2
Pratikshya (check)	122	114.8	4.6
Mean	126	100.4	2
LSD (5%)	2	5.8	1.3
CV (%)	2	2.8	17.6

progenies from 27 cross combinations developed for submergence tolerance were grown during *kharif* 2009. At the time of flowering and maturity, 168 single plant selections were made from 21 cross combinations on the basis of submergence tolerance, plant and panicle characters. Besides, four mapping populations IR 42/Khoda, IR 42/Kalaputia, IR 42/Atiranga and IR42/Matiaburusu that are being developed to identify new genes for submergence tolerance and regeneration ability were generation advanced (F_5-F_6).

AICRIP Trial: AVT 2-NIL-SUB

Three NILs (Swarna-*Sub1*, IR 64-*Sub1* and Samba Mahsuri-*Sub1*) developed for submergence tolerance by incorporating *Sub1* QTL and original parents (Swarna, IR 64 and Samba Mahsuri) received from DRR under AICRIP trial AVT 2-NIL-SUB along with two check varieties (Satabdi and Pratikshya) were evaluated under normal and submergence conditions. Under stress, all three NIL's showed significantly higher tolerance to submergence than the parents and check varieties. Among the different NIL's Swarna-*Sub1* yielded 4.8 t/ha followed by Samba Mahsuri-*Sub1* (3.5 t/ha) and IR 64-*Sub1* (2.9 t/ha). The results are given in Tables 46 and 47.

Based on two years (2008-2009) of testing under AICRIP, Swarna-*Sub1* was found promising for flood-prone areas of Orissa and Uttar Pradesh. IR 64-*Sub1* was promising in Orissa and Assam.

Stress Tolerant Rice for Poor Farmers of Africa and South Asia- Submergence and Flood-prone Areas

Researcher Managed PVS Trials (Mother Trials): During *kharif* 2009 researcher managed mother trials were conducted at Nuagaon village of Jajpur district, Hansapur village of Bhadrak district and CRRI, Cuttack under replicated condition. The trial at Nuagaon was under direct seeded condition, whereas at Hansapur and CRRI, Cuttack it was under transplanted condition. A set of 14 genotypes, including Swarna-*Sub1*, Samba Mahsuri-*Sub1*, Savitri-*Sub1* and BR 11-*Sub1* along with the parents, improved lines CR 2003-2-1, OR 2329-13, CR 874-59-2-2, IR 53945-CN-35-53 and CR 2459-12, standard check Pratikhya and local check Banksurua were selected for evaluation. The promising cultures were mostly selected from the top-ranking entries from the previous year AYT.

At Hansapur the experiment site did not experience submergence. Among the different entries Swarna-*Sub1* gave the highest yield of 5.2 t/ha followed by Savitri (4.9 t/ha) and CR 2003-2-1(4.90 t/ha) as against 1.2 t/ha in the local check Banksurua. At Nuagaon, the crop was severely affected by gundhi bug. In most of the entries the grain yield was low except in a few late duration genotypes. Among the different entries Savitri produced the highest grain yield (4.1 t/ha) followed by Savitri-*Sub1* (3.7 t/ha), OR 2329-13 (3.4 t/ha) and Swarna-*Sub1* (2.5 t/ha) as against the local check Banksurua (1.4 t/ha). At CRRI, Cuttack among the different entries Pratikshya produced the highest grain yield (5 t/ha) followed by Swarna (4.9 t/ha) and CR 2159-12 (4.8 t/ha) as against 4 t/ha on the local check Banksurua. The *Sub1* lines yielded 3.6 t/ha to 4.4 t/ha. Results over three locations showed that among the 14 entries, Savitri had produced the

highest grain yield of 4.9 t/ha followed by Savitri-*Sub1* (4.1 t/ha) and Swarna-*Sub1* (4 t/ha).

Farmer Managed PVS Trials (Baby Trials): In *kharif* 2009, five villages each from three coastal districts (Jajpur, Bhadrak and Balasore) of Orissa were selected. In each village, 10 farmers with submergence-prone lands were selected. Each farmer was supplied with a kit of Swarna-*Sub1* along with Swarna and other suitable popular lowland varieties.Out of the 50 trials in Jajpur district, three trials were completely damaged due to severe floods. The yield in Swarna-*Sub1* ranged from 1.3 t/ha to 6.3 t/ha as against the check Swarna.

In Bhadrak district, out of the 51 trials, seven trials were completely damaged due to severe floods. In 15 trials, Swarna was completely damaged due to floods, whereas Swarna-*Sub1* yielded 2 t/ha to 5 t/ha.

In Balasore district, where the trials were not affected with submergence, Swarna-*Sub1* yielded 2 t/ha to 6.4 t/ha as against 2 t/ha to 5.4 t/ha in check Swarna. Results confirm that Swarna-*Sub1* had significant yield advantage over Swarna, whenever the crop was affected by floods. On the other hand, under normal conditions, where there was no flood, Swarna-*Sub1* and Swarna produced more or less similar yields.

Eastern India Rainfed Lowland Shuttle Breeding Network (EIRLSBN): The following activities were under taken during *kharif* 2009.

Distribution of Seed: Seed for OYT and AYT was distributed to different cooperating centers during May 2009. About 50 F_2 populations including the crosses received from the IRRI, Philippines and crosses developed at CRRI, Cuttack were distributed.

Observational Yield Trial (OYT): Among the 80 entries tested along with five checks in an unreplicated OYT, CN 1230-20-1-16-1-35-3 produced the highest yield of 4.5 t/ha followed by CN 1230-4-39-2-31-1 (4 t/ha), LPR 09005 (4 t/ha) and LPR 09009 (4 t/ha) as against 3.3 t/ha in best check Sabita.

Advanced Yield Trial (AYT): Among the 25 entries tested, IR 70153-TTB-9-3-3-1-2 performed best with an average yield of 3.2 t/ha followed by CR 2008-111-4 (3.1 t/ha) and IR 49830-7 (3.1 t/ha) as against 3 t/ha in the best check Sabita.

Enhancing and Stabilizing Productivity of Salt-affected Areas through Incorporation of Genes for Tolerance of Abiotic Stresses in Rice and Stress Tolerant Rice for Poor Farmers of Africa and South Asia-Saline-prone Areas

Evaluation of Promising Varieties/elite Lines: In *rabi* 15 salt-tolerant rice varieties/lines were evaluated in farmer's field in Ersama block of Jagatsinghpur district, Orissa. Line CR 2472-33-57-1 yielded 6.5 t/ha and was significantly superior to IR 72046-B-R-3-3-3-1 (5.6 t/ha). CR 2485-7-3-45-1 (6.1 t/ha; 110-115 days) and CR 2472-1-6-2 (6.1 t/ha; 105-110 days) were comparable to CR 2472-33-57-1 (5.6 t/ha). Four other CRRI lines CR 2473-28-150-1 (5.8 t/ha; 100-105 days), CR 2473-1-123-3 (5.6 t/ha; 100-105 days), CR 2472-4-28-2 (5.5 t/ha; 105-110 days) and CR 2472-2-38-2 (5.4 t/ha; 105-110 days) were comparable to IR 72046-B-R-3-3-3-1 (5.6 t/ha). Among five varieties from Vietnam, OM 6050 (6 t/ha; 115-120 days), OM 6051 (5.9 t/ha; 110-115 days) OM 6049 (5.8 t/ha; 115-120 days) and OM 5900 (5.9 t/ha; 115-120 days) were also comparable to IR 72046-B-R-3-3-3-1 (5.6 t/ha). The PVS was conducted by 30 (men and women) farmers. The two most preferred genotypes were CR 2472-1-6-2 and OM 6051. In sensory evaluation, farmers selected OM 6051 for its sweet taste, white kernel, good smell and softness.

In *kharif* 2009, 13 salt-tolerant varieties/lines were evaluated in Ersama and Astaranga using SR 26B and Lunishree (maturity duration 145-150 days). Line CR 2092-141-2 in 145-150 days yielded 4.6 t/ha in Ersama and 3.8 t/ha in Astaranga. This was significantly superior to SR 26B (4 t/ha in Ersama and 3.1 t/ha in Astaranga). CR 2462-1-154-1-1 was superior to SR 26B at Ersama (4.5 t/ha) but not at Astaranga. The PVS was conducted by 39 farmers at Ersama and 33 farmers in Astaranga. Based on the preference score, the two most preferred genotypes were CR 2218-64-1-327-4-1 and CR 2092-141-2 at Ersama, and CR 2218-64-1-327-4-1 and CR 2462-1-139-1-1 at Astaranga.

Multiplication and Distribution of Seed of Salt-tolerant Rice Varieties: In *rabi*, 4.6 t of seed of improved varieties/lines (IR 72046-B-R-3-3-3-1, IR 66401-2B-6-1-3 and Annapurna) were distributed to 860 farmers from 23 villages in Ersama, Astaranga and Mahakalpada blocks of Kendrapara district. The performance of IR

72046-B-R-3-3-3-1 *vis-à-vis* farmers' variety (Khandagiri / Naveen) was assessed by 300 farmers in Ersama. Farmers reported a yield of 4 to 6 t / ha with the IRRI line (IR 72046-B-R-3-3-3-1), as against 3 to 5 t / ha with their own varieties. About 430 farmers got 20% to 50% extra yield and a quarter of them reported 10% to 20% yield advantage with the IRRI line (IR 72046-B-R-3-3-3-1).

During *kharif*, 1.6 t of seed of rice SR 26B and Pankaj was distributed to 264 farmers from 18 villages in Ersama, Astaranga and Mahakalpada blocks. SR 26B yielded 3.7-34.1% higher at Ersama and 9.2-225% higher in Astaranga. Besides, 5.5 t of seed of short-duration varieties / lines were multiplied in *kharif* in farmers' fields and distributed to 824 farmers in 36 villages for *rabi*.

Best Bet Management: In on-farm trials conducted at nine sites in Ersama during *rabi*, improved rice (IR 72046-B-R-3-3-3-1) with improved management (early planting, use of *Azolla* biofertilizer with chemical fertilizer and need-based plant protection) yielded 5.1-7.2 t / ha as against 4.2-5.6 t / ha for the farmer's variety Khandagiri with farmer's management (late planting and use of chemical fertilizer alone). The yield advantage due to improved variety and improved management was 15.5-41.2%.

Swarna-*Sub1* Released for Cultivation

RICE Swarna-*Sub1* (CR 2539-1; IET 20266) developed from Swarna*3 / IR 49830-7-1-2-3 at the IRRI, the Philippines by marker-assisted backcross breeding, and further developed and tested by the CRRI, Cuttack in farmers' field conditions in flood-prone conditions for three years was released for cultivation in shallow lowland areas of coastal Orissa by the Orissa State Seed Sub-Committee of Agricultural Crops. Swarna-*Sub1* with all qualities of rice Swarna yields 5 to 5.5 t / ha in 140 to 145 days. It is tolerant to complete submergence between 15 and 17 days, and is also suitable for late planting with aged seedlings. Swarna-*Sub1* was approved for notification by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties.

J.N. Reddy

Natural Resource Management and Input-use Efficiency for Improved Crop Production

AICRIP Trials

Six trials were conducted in different rice ecosystems during *kharif* 2009 under AICRIP to determine production potential of selected AVT-2 rice cultures and its response to varying levels of nitrogen. The results are in Table 48.

Nutrient Management for Organic Rice

Results of an experiment of eight treatments in rice Geetanjali at CRRI, Cuttack showed the yield average from 2.3 t/ha to 2. 8 t/ha with different treatments (Table 49).

The N uptake by grains in rice Geetanjali was significantly higher under all treatments than the control (Table 50).

Agrotechniques for indigenous aromatic rice for enhancing yield of aromatic short grain cultivars was conducted during *kharif* 2009 with rice Kalajeera. Results showed that the dates of planting did not have any significant influence on grain yield. However, early planting gave maximum grain yield of 4.5 t/ha that was 13.7% and 14.9% higher than 10 days and 20 days delayed planting. The results are in Table 51.

Results showed that the quantum of root exudates from all the rice expressed in terms of total organic carbon (µg C/g/d) was significantly higher at 21 DAS transplantation (135-210 µg C/g/d) than at panicle initiation (PI) or flowering stages (Table). Secretion of organic acid was significantly low in rice hybrids Ajay and Rajalaxmi than in P-tolerant (IR 28 and IR 20) and P-susceptible variety such as IR 36. The quantity of individual organic acids released from the roots followed the sequence tartaric acid > malic acid> acetic acid.

Table 48. Performance of entries in AICRIP trials, *kharif* 2009.

Trials (number)	Entry	Yield (t/ha)	N-response (kg N/ha)
AVT-2 (Late) (8)	IET 20261	6.8	80
	Pooja	6.6	
	IET 20262	6.2	
AVT-2 (IM)	Jaya	5.2	60
AVT-2 (ME)	KRH 2	4.9	60
	IET 20419	5.4	
	IET 20427	5.3	
AVT-2 (DW)	IET 20214	4.6	40
	Durga	5.2	
AVT-2 (NIL)	BPT 5201	5.5	80
	IET 21248	5	
AVT-2 (NIL) BLB	IET 21070	5.5	80
	Tapaswini	5.9	
AVT-2 (ME) Aerobic	IET 20053	5.5	120
	IET 20649	4	
	IR 64	2.3	

Microbial Resource Management and Diversity Analysis

Among the 733 bacteria isolated from 10 coastal soils of Orissa (Arunpur, Chilika, Haripur, Humma and Indrakhi) and Andhra Pradesh (Kalipatnam, K.P. Palem, Gondhi, Shankaraguptam and Undi), 186 isolates produced IAA 18.71-

Table 49. Nutrient management for organic rice.

Treatments	Yield (t/ha)	
	Grain	Straw
FYM	2.7	4.8
Dhaincha	2.7	4.9
FYM+ dhaincha	2.7	4.5
FYM + Azolla	2.8	4.1
Crop (rice) residue 5 t + dhaincha	2.4	5.3
Azolla + dhaincha	2.7	5.2
Crop (rice) residue 2.5 t + dhaincha	2.5	4.4
Control	2.3	4

Table 50. Nutrient management for organic rice.

Treatment	Grain	Straw	Total
FYM	30.4	32.5	62.9
Dhaincha	32.3	37.2	69.5
FYM + dhaincha	33.5	33.8	67.4
FYM + Azolla	31.6	24.8	56.3
Crop (rice) residue 5 t + DH	28	34.6	62.7
Azolla + dhaincha	31.9	33.2	65.1
Crop (rice) residue 2.5 t + dhaincha	28.9	31.2	60.2
Control	24.7	23.7	48.5

362.96 µM / ml, 41 isolates P solubilized and 70 isolates utilized ACC. Among the IAA isolates, isolates from Indrakhi (n=3) produced highest IAA of 67.09-362.96 µM.

Ten isolates (AR-NA5, ANR-TSY4, ANR-TSY/1000-3, AR-ACC1, AR-ACC2, AR-ACC3, AR-ACC4, ANR-ACC1, ANR-ACC2 and ANR-ACC3) with IAA and ACC deaminase activity were used for plant growth assay to see the effect of the bacteria on growth of rice Naveen under net house condition. The growth promotion effect by the PGPR exhibited on root length of rice seedlings and was 30% to 120% more than the untreated seedlings. The shoot growth increased by 10% to 140% by the PGPB. Chlorophyll *a* and *b* contents of the treated seedlings also increased by 1.2-2.12% over the untreated seedlings.

Among 10 promising isolates three strains AR-ACC1, ANR-ACC2 and ANR-ACC3 were identified by 16S rDNA sequencing as the most potent PGPR isolates. These were similar to *Microbacterium* sp. K6-01; EF 612295, *Agromyces sp*. 28-4; EU 363710 and *Paenibacillus* sp. (GQ 288410), respectively.

The role of microbes in nutrient acquisition and plant growth promotion in rice was also studied. In soils collected from Balasore district, 25 P-solubilizing bacteria were isolated that solubilized P 1.51-62.60 µg / ml. The isolates identified as TALP (n=6) was poorest and TAL S11 (n=4) as most potent P- solubilizers. Growth of P-solubilizing bacteria caused acidity of media (pH 3-4). Maintenance of pH 7 of the medium reduced P-solubilization capacity of the organisms. Out of the 19 P solubilizers, Arun 7 tolerated 15% but others tolerated 9% NaCl. Kinetics of P-solubilization of Arun 7 declined gradually with increase in salt level. Further *B. megaterium* and *Enterobacter* sp. were tested for effect on growth with 10 rock phosphate samples. *B. megaterium* was more effective in releasing P in soil. The length of shoot and root and dry mass increased but was less effective than SSP. North Carolina and Gafsa rocks were effective P source and comparable in presence of *B. megaterium*.

In addition, 23 P-solubilizing bacteria were checked for IAA, siderophore and HCN production. All isolates produced IAA and Tals 6, Tals 7, Kash 7 and Chilka 5 produced more IAA. Four P-solubilizers Tals 2, Tals 3, Tals 4 and Tals 6 were efficient siderophore producers with discoloration (orange) zones of diameter 6-10 mm. No P-solubilizer produced HCN. HPLC analysis showed Tals 4 produced organic acids D-gluconic acid, acetic acid, citric acid, malic acid, malic acid and tartaric acid. Some unknown acids with R_T 2.1-2.9, 8.1-8.9 and 9.01-9.7 were also produced by the organisms.

Table 51. Organic acid content of root exudates of five rice cultivars planted to P deficient soil (Khuntuni soil) and grown under flooded conditions.

	Organic acid content (µ mol / plant/ d) in root exudates								
	Tartaric acid			Malic acid			Acetic acid		
Rice	21 DAT	PI	Flowering	21 DAT	PI	Flowering	21 DAT	PI	Flowering
No P									
Ajay	22.9	37.6	23.2	15.9	19.3	18.6	6.9	7.2	6.7
Rajalaxmi	25.3	48.8	26.5	16.4	20.6	20	7.4	7.8	7.2
IR 20	37.9	60.3	36.2	20.6	26.7	24.8	10.3	11.7	10.1
IR 28	39.6	69.9	39.4	24.5	29.1	25.2	10.5	12.6	10.8
IR 36	32.2	53.2	31.7	18.3	23.8	22.1	9.6	10.4	9.4
CD (5%)	2.28	0.15	0.13						
P @ 50 mg / kg									
Ajay	20.1	25.9	23	16.9	19.1	17	5.5	5.9	5
Rajalaxmi	21.6	26.7	23.5	17.3	19.7	17.5	5.7	6.1	5.3
IR 20	30.1	33.5	30.6	20.1	22.9	20.8	6.7	7.3	6.8
IR 28	32.3	34.7	32.8	20.3	23.4	21.1	6.9	7.8	7
IR 36	29.8	30	29.6	19	21.5	19.6	6	6.9	5.8
CD (5%)	2.28	0.15	0.13						
P @ 100 mg / kg									
Ajay	19.7	22	19.3	10.1	12.2	11.1	1.1	1.3	1
Rajalaxmi	20	22.1	20	10	13	11.6	1.3	1.5	1.4
IR 20	27.6	30.5	27.1	17.2	180	16.6	3.1	3.3	3
IR 28	28	31	27.6	17.6	18.6	16.9	3.2	3.5	3
IR 36	24.1	28	25	16.1	17.1	15.0	1.7	2.0	2.2
CD (5%)	2.28	0.15	0.13						

In soils collected from different places for heterotrophic ammonia oxidizing bacteria 33 potent heterotrophic nitrifiers were isolated from CRRI, Cuttack, Canning, Talchua, Khola, Gupti and Ersama. Isolates CRRI 12, CRRI 14 and (G 10) Gupti were identified by 16S rDNA sequencing as *Bacillus* sp., *Lysinibacillus* sp. and *Bacillus* sp., respectively. Besides, the C-cycle microbes comprised of methanotrophs and 10 methylotrophs were isolated from CRRI, Cuttack, Canning, Talchua, Khola, Gupti and Ersama. Three isolates utilized methanol namely, CRRI 21, CRRI 24 and Ers 2. These were identified by 16S rDNA sequencing as *Sinorhizobium* sp., *Cupriavidus necator* and *Sinorhizobium* sp., respectively.

The effect of different levels of N on microbial diversity was also studied to understand microbial functional dynamics under different N rates. The microbial population was more in 80 kg N / ha and 120 kg N / ha than in the control and 40 kg N / ha. Methanotrophs, denitrifiers and ammonium oxidizers were more in 80 kg N / ha than in 120 kg N / ha. Microbial diversity and population was variable but more broadly at maximum tillering stages.

Activities of soil enzymes (urease, dehydrogenase and fluorescein diacetate) hydrolysis under different N rates were also assessed. Dehydrogenase activity was maximum (220.41 ìg / g soil / h) in 120 kg N / h treatment at maximum tillering stage. The FDA activity was maximum (3.651 Fluorescin µg / g / h) in 80 kg N / h treatment at maximum tillering stage. But the urease activity was observed to be maximum (84.01 mg / g soil / h) in 80 kg N / h and 120 kg N / h treatments at grain filling stage.

Pesticide Biodegradation in Rice Soils

In a study on pesticide biodegradation in rice soils, the abundance of Chlorpyriphos degrading bacteria were more in planted rice (variety Naveen) and Chlorpyriphos (10 ìg / ml) treated pots than in the non-planted un-treated pots. About 99.6% insecticide was metabolized in planted / treated conditions. But it was only 60% to 80% in the other soils. Further, three bacteria (one of the isolates was similar to *Labrys monachus* (T) (NCBI accession number AJ 535707) and the other was identified as *Inquilinus limosus* (NCBI accession number AY 043373)) of West Bengal coastal saline rice soils that degraded the total quantity of Chlorpyriphos (10 ìg / ml) in MS medium within 12 to 15 days. The optimum temperature for Chlorpyriphos degradation for the potent isolate CH 23 was 35°C and about 99.9% of the chemical was detoxified by the bacteria after 15 days incubation.

Enhancing and Sustaining the Productivity of Rice-based Farming Systems

Optimization of Organic and Inorganic Sources of Nutrients for Enhancing Productivity and Soil Fertility

Characterization of organic inputs and yield of rice cultivar Gayatri under eight different treatments were studied. Results are in Table 52.

Integrated Weed Management in Upland Rice

This experiment was carried out during *kharif* 2009 with an objective to study the influence of intercropping on weed density, yield and yield attributes of upland rice and associated crop. Cowpea C 410 was grown as an intercrop with rice Vandana in different row ratios, and cowpea and rice crop were also raised as sole crops. It was observed from the results that significant reduction was caused by cowpea than rice when both the crops were grown as sole crop. Rice and cowpea (5 : 1) grown in an additive series or in 4 : 2 in a replacement series in the intercropping system resulted in significant biomass reduction of weeds compared to sole crops of the respective crops.

Among the weed control treatments, two hand weeding treatments reduced weed biomass significantly and produced least biomass yields of rice and cowpea were also influenced by weed management practices. Rice and cowpea intercropping system (4 : 2) produced highest rice equivalent yield and intercropping in general proved superior to pure crops of both rice as well as cowpea (Table 53).

Diversified Rice Farming Systems for Favourable and Unfavourable Upland Ecologies

Rice Vandana was grown as an intercrop with cowpea C 1111 in different row ratios as well as sole

Table 52. Optimization of organic and inorganic sources of nutrients.

Treatment	Yield (t/ha)		Total (grain + straw) N uptake (kg /ha)
	Grain	Straw	
Urea 60 kg N/ha in 3 splits (50 + 25 + 25)	5.5	8.2	78.03
2.5 t/ha crop residue (rice straw) + 45 kg N/ha (urea) in splits	4.9	6.6	63.25
2.5 t/ha crop residue (rice straw) + 60 kg N/ha (urea) in splits	5.8	8.7	84.2
2.5 t/ha crop residue (rice straw) + 60 kg N/ha (dhaincha)	5.5	8.9	84.39
5 t/ha crop residue (rice straw) + 30 kg N/ha (urea) in split	5.3	7.2	79.8
5 t/ha crop residue (rice straw) + 60 kg N/ha (urea) in split	5.5	8.2	81.45
5 t/ha crop residue (rice straw) + 60 kg N/ha (dhaincha)	5.2	8.3	78.19
Control	3.9	4.7	48.23
C.D. (5%)	0.45	0.93	6.4

Table 53. Effect of different cropping systems and weed control measures on growth of weeds and productivity of upland rice.

Treatment	Weed biomass (g/m²)	Change (%)	Yield (t/ha)		Rice equivalent yield (t/ha)	LER
			Rice Vandana	Cowpea C 410		
Cropping Systems						
Rice sole	110.8	-	1.9	-	1.9	1
Cowpea sole	67	39.5	-	0.7	1.9	1
Rice + CP (4:1)	54.3	51	1.3	0.3	2.2	1.15
Rice + CP (4:2)	44.7	59.7	1.3	0.4	2.5	1.32
Rice + CP (5:1)	33.5	69.8	1.4	0.3	2.3	1.19
LSD (0.05)	14	-	0.3	0.2	0.3	-
Weed regimes						
1 HW	89.5	-	1.3	0.6	2.9	1.3
2 HW	41.8	53.3	1.8	0.8	4	1.32
LSD (0.05)	36	-	0.41	ns	0.15	-

crop. The results are given in Table 54. The results revealed that intercropping treatments gave higher rice equivalent yield than sole crops. Intercropping of rice Vandana with cowpea C 1111 gave 0.5 t/ha higher rice yield in terms of rice equivalent yield of the sole crop of rice.

Consortium for Unfavourable Rice Environments, Working Group 1, Indian Plateau Uplands

The Consortium for Unfavourable Rice Environments (CURE) is a platform for National Agricultural Research Systems (NARS) working on rice and the IRRI, Philippines to work together to address key common problems in sites representative of the diverse ecosystems.

Farmer Participatory Varietal Selection: PVS was done in three villages with drought tolerant genotypes of less than 120 days duration. Apart from Sahbhagi Dhan which was selected consistently by farmers across all the villages, the other selections were R RF 23 and IR 78908-193-B-B. R RF 23 was the earliest among the test entries, had highest 1,000 grain weight and also topped the entries for mean yield on-farm (Table 55).

Nutrient-use Efficiency: Twelve drought tolerant genotypes of less than 120 days including checks were evaluated under a range of nutrient supply and drought conditions. The results are in Table 56.

Transplanting Age: The same set of genotypes that were evaluated for nutrient-use efficiency were also tested for the performance under different transplanting ages. The mean grain yield was reduced by 33% and 63% when transplanting was delayed by 10 days and 20 days. Flowering was delayed and plant height reduced significantly by late transplanting. IR 78908-193 had the least reduction in grain yield (3.1 t/ha), followed by IR 74371-54-1-1 (2.8 t/ha).

Agronomy of Newly Released Varieties: Rice Abhishek and Sahbhagi Dhan were evaluated with checks in the middle and upper topo-sequences representing rainfed

M. Variar

Rice Sahbhagi Dhan was selected consistently by farmers across all the villages in the PVS.

Table 54. Evaluation of different cowpea cultures for intercropping in rice-based cropping systems.

Treatment	Yield (t/ha)					Rice equivalent yield (t/ha)
	Rice	Reduction (%) in rice yield	Cowpea	Reduction (%) in cowpea yield	Total	
Rice sole	1.8	-	-	-	1.8	1.8
Cowpea sole 1245	-	-	0.3	-	0.3	0.5
Cowpea sole 452	-	-	0.6	-	0.6	0.9
Cowpea sole 205	-	-	0.7	-	0.7	1
Cowpea sole 1111	-	-	0.5	-	0.5	0.9
Cowpea sole 1042	-	-	0.3	-	0.3	0.4
Rice[1] + CP 1245	1.5	15.8	0.2	25	1.8	1.9
Rice[1] + CP 452	1.4	26.1	0.4	35.6	1.7	1.9
Rice[1] + CP 205	1.3	30.4	0.5	32.4	1.7	2
Rice[1] + CP 1111	1.6	10.9	0.4	25.5	2	2.3
Rice[1] + CP 1042	1.4	21.7	0.2	17.2	1.7	1.8
LSD (0.05)						0.32

[1]Rice variety Vandana; Cowpea C 1111.

Table 55. Performance of PVS entries of 100-120 days duration (*kharif* 2009).

Entries	DFF	Plant height (cm)	1,000 seeds grain weight	Yield (t/ha)		Preference index
				Station	Farm	
IR 55419-04	88.3	112.3	22.6	3	3.3	0.7
IR 70215-70-3	92.7	94.8	24.2	2.7	3.2	-1.6
IR 70844-10-1	102.3	48.7	22.7	0.4	2.9	-22.1
IR 74371-54-1-1	88.3	89.6	21.1	3	2.7	-3.8
IR 74371-70-1-1	87	89.9	20.7	2.7	3.4	6.6
IR 78908-193-B	87.7	108.3	23.1	2.7	3.3	12.3
IR 83614-281-B	93.3	110.8	18.9	2.5	2.6	2.4
IR 83614-673-B	78.3	97.1	21.9	3.2	2.7	3.3
R-RF-22	83.3	79.6	22.6	3.2	2.3	3
R-RF-23	78.3	85.6	27.3	3.4	4.5	17.4
R-RF-65	90.7	71.8	27.2	4.5	3.8	2.1
R-RF-69	88.7	76.3	23.2	3.1	3.8	7.2
IR 64	84.3	68.8	21.6	3	2.5	-10
MTU 1010	87	70.7	21.1	3.3	3.3	-2.8
Hazaridhan	86	59.7	23.3	2.7	NT	NT
5%LSD 30DF	0.96	15.78	1.12	715.9		

Table 56. Effect of nutrient levels on drought tolerant genotypes, Hazaribag, *kharif* 2009.

Fertilizer levels	DFF	Plant height (cm)	Tiller number	Panicle number	Yield (t/ha)
F1 N-P_2O_5-K_2O 0-0-0 t/ha	90.8	100.1	5.2	4.8	4
F2 N-P_2O_5-K_2O 45-30-20 t/ha	90.3	102.5	5.4	5.1	3.8
F3 N-P_2O_5-K_2O 90-60-40 t/ha	89.8	102.6	5.3	4.9	4.3
5% LSD 72 DF	1.78	2.37	0.52	0.49	282.9

shallow drought prone lowlands. In the middle toposequence Abhishek yielded 6.6 t/ha. In the upper toposequence Sahbhagi Dhan yielded 5.5 t/ha. Yield differences were not significant at different fertilizer levels though mean grain yields were higher at 150% of the recommended fertilizers.

Strategic Research on Pathogens/Pest Population Dynamics, Crop Losses, Forecasting

Studies on Pest Outbreaks and Resurgence in Rice Ecosystem

Swarming Caterpillar in the Harichandanpur Block of Keonjhar: There was an out-break of swarming caterpillar in the Harichandanpur Block of Keonjhar district of Orissa during the last week of Jul 2009. The damage was 90% in about 300 ha. Rice Gayatri, Lalat, Indrabati, Kamal, Nali Swarna, MTU 1001 and Konark were severely affected. The pest was controlled by application of methyl parathion dust @ 25 kg/ha and Hildan @ 2 ml/litre.

BPH: Severe BPH damage was reported from Salipur, Nischitkoili, Mahanga and Narasinghpur blocks of Cuttack district during the second week of Oct 2009. Carbofuran and Phorate at initiation of hopper burn could not control the damage.

YSB: Heavy YSB damage (WEH) was seen in Pipili block of Puri district where scented rice such as Dhusara and other local scented varieties were grown. Variety Sarala also suffered 40-45% WEH.

Survey for the Incidence of Major Rice Diseases in Assam and Other North-eastern Regions

A survey was conducted in different districts of Assam and other North-eastern regions during *sali/kharif* 2009 to know the popular rice cultivars grown and common rice diseases observed in those areas (Table 57).

Table 57. Survey for incidence of rice diseases in different districts of Assam.

Area surveyed	Rice varieties	Disease incidence (0-9 scale)						
		Blast	Brown spot	Sheath blight	Sheath rot	BLB	BLS	False smut[1]
Kamrup								
Dimu G.P.-Dimu Dibok Rangiya	Ranjit, Bahadur, Tulsi Joha, Nal Barni, Aijung, Mahsuri	5	5	1	-	3	1	-
No.Dubok G.P.-Dimu Dibok Rangiya	Ranjit, Aijung, Bahadur, Badshabhog, Nal Barni	-	5	-	3	-	3	-
Niz Barikob Gaon G.P.-Same Rangiya Sandhiya G.P.-	Aijung, Baismuthi, Kola Barni	4	3	-	7	-	-	7.96
Padum Kunwari Rangiya	Baismuthi, Aijung, Ramjet, Bahadur	-	6	-	-	5	-	-

Table 57. Survey for incidence of rice diseases in different districts of Assam (concluded).

Area surveyed	Rice varieties	Disease incidence (0-9 scale)						
		Blast	Brown spot	Sheath blight	Sheath rot	BLB	BLS	False smut[1]
Sarpara G.P.- Same Jharoguri	Aijung, Boka, Ranjit, Baismuthi	7	2	-	-	1	-	-
Boko Subdivision	Ranjit, Swarna Mahsuri	5	2	3	1	3	-	-
Budhipara G.P.- Baladmarichar	Ranjit, Bahadur, Aijung	5	3	3	1	7	-	-
Krishnai G.P.- Baladmarichar	Ranjit, Bahadur	3	4	3	3	7	-	-
Dudhinoi G.P.- Same	Ranjit, Aijung, Patisali, Moinagiri	5	6	1	1	5	1	3.48
Bongaigaon	Ranjit, Mahsuri, Jaya, IR 36, Katisali, Baismuthi, Tengrai	5	4	3	-	1	-	-
Karbi Anglong	Ranjit, Bahadur, Arize 6444, KRH 2, IR 36, IR 50, Jaya, Luit	3	5	5	-	3	-	3.97
Koriya Betkata (Chopa) G.P.- Borbhag 52 Nalbari	Barni, Ranjit, Baismuthi, Aijung, Tulsi Joha, Kola Joha	-	5	-	5	3	7	-
Tarmotha G.P.- 51 (b) Nalbari	Barni, Baisumuthi, Aijung, Ranjit, Bahadur, Lachit, Engre, Kola, Joha	-	6	3	5	-	-	3.66
Elengigaon G.P.-7 No. PubbahzaniNalbari	Ranjit, Aijung, Baimuthii	7	2	1	3	3	7	-

[1]% infected panicles.

Developing IPM Technologies for Different Rice Ecologies

Studies on Components of IPM

Chemical Control Measures against Field Pests

Granular formulations of insecticides Carbofuran, Phorate, and Cartap each @ 1 kg ai/ha and Chlorpyriphos @ 0.5 kg ai/ha along with spray formulation of Monocrotophos @ 0.5 kg ai/ha were tested against insect pests of rice Jaya during *kharif* 2009. Carbofuran recorded the lowest DH 6.7% and WEH of 3.7% followed by Phorate, Cartap, Chlorpyriphos and Monocrotophos. All the insecticides were effective against YSB (Table 58).

Under residual toxicity study, foliar spray of Chlorpyriphos @ 0.5 kg ai/ha at PI stage showed the persistence of detectable insecticide residues in the plant up to 13 days after treatment. Bioassay of plants in net-house condition showed 100% mortality of BPH up to second day (1.42 m/g) and up to 50% mortality on the fifth day of the treatment (0.24 microgram/gm). The mortality of the test insect decreased with the decrease of residues still further.

Beauvaria bassiana and *M. anisopliae* were effective in the laboratory (Table 59). These were evaluated in the field against leaffolders. *M. anisopliae* was the most effective pathogen causing 80.77% mortality (Table 60).

Table 59. Virulence assay of the fungal entomopathogens in the laboratory.

Dosage	Mortality (%)	LC 50
Beauvaria bassiana		
2.08×10^7	50	2.08×10^7
2.08×10^6	33.5	
2.08×10^5	0	
Control	0	
Metarhizium anisopliae		
1.20×10^7	58.3	9.01×10^6
1.20×10^6	23.3	
1.20×10^5	9.12	
Control	0	

Table 58. Chemical control of insect pest of rice *kharif* 2009.

Treatment	DH (%)[1]	WEH (%)	Grain damage (%)[2]	Yield (t/ha)
Carbofuran (1 kg ai/ha)	6.7 (15)	3.7 (11)	7.78 (16.2)	3.2
Phorate (1 kg ai/ha)	7.2 (15.5)	3.9 (11.3)	8 (16.4)	3.1
Cartap (1 kg ai/ha)	7.1 (15.4)	3.7 (11.1)	8.1 (16.5)	3.1
Chlorpyriphos (1 kg ai/ha)	7.4 (15.7)	3.7 (11.1)	8.4 (16.8)	3
Monocrotophos (0.5 kg ai/ha)	7.8 (16.2)	4.5 (12.2)	9.3 (17.7)	2.9
Control	9.8 (18.2)	5.8 (13.9)	13.6 (21.7)	2.1
CD @ 5 %	2.02	1.19	1.72	0.3

[1]Data in parenthesis are angular transformed values. [2]Gundhi bug.

Table 60. Field testing of pathogens against LF, k*harif* 2009.

Pathogen	Dose	Mortality (%)
Metarhizium anisopliae	7.8×10^6	80.8
Beauvaria bassiana	12.4×10^7	69.6

Table 61. Evaluation of pesticides against rice panicle mite.

Pesticide	Dosage (g ai / ha)
Diafenthiuron (Polo) 50% wp	450
Abameetin (Vermitec) 1.9% EC	9
Fepyroxmate (Sedam) 5% SE	30
Milbemectin (Milbeknock) 1%	4.5
Kelthane (Dicofol)18.5% EC	500
Propargite (Omite) (57% EC)	400

Botanicals Grain Protectants and Pheromones against Rice Storage Insects

Citronella oil (*Cymbopogan nardus*) @ 1 ml / kg treatment in polybags each containing 5 kg grains of rice Dhusra was effective as a grain protectant and absolutely controlled the population build-up of Angoumois grain moth, *Sitotroga cerealella* Olivier for a period of six months under controlled conditions of infestation.

Pheromone, Sitophilure (Z6-E11) 16Ac. of *Sitotroga cerealella* was tested for the first time in India in the CRRI. Among the four kinds of traps tested, the use of simple plastic tray with lure with petroleum jelly as trapping medium was efficient in trapping more than 101% than the delta trap. When the area for trapping was increased in the delta trap to 893 cm^2, there was an increase of 171.1% males than the delta trap that has a trappable area of 360 cm^2 and recorded a mean of 87.7 males. Even in the traps with three sides glue recorded 62.1% more males than the delta trap.

Studies on Biodiversity and Chemical Control of Rice Mites

Out of six pesticides, Diafenthiuron, Abameetin (Vermitec), Fepyroxmate, Milbemector, Kelthane and Propargite evaluated during *kharif* 2009 against rice panicle mite, *Stenotarsomus spinki* under field conditions, Milbemectin was the most effective (Table 61).

Table 62. Insecticide evaluation trial during *kharif* 2009.

Insecticide	Dosage (ml / ha)	DH (%)	WEH (%)	Gundhi bug (%)	Yield (t / ha)
RIL-IS-109	875	7.8 (16.2)	4.7 (12.5)	9 (17.4)	3.2
Monocrotophos	1,390	8.3 (16.7)	5.1 (13.1)	10.3 (18.7)	3
Acephate 95 SG	592	8.2 (16.7)	5 (12.9)	10.4 (18.7)	3
Flubendiamite	175	8.5 (16.9)	5 (13)	11.6 (19.8)	3
Dinotefuron 200	200	8.3 (16.7)	5.1 (13.1)	11.3 (19.7)	3
Dinotefuron 150	150	8.1 (16.5)	5.2 (13.1)	10.7 (19)	3
Buprofezin	700	8.6 (17)	5.1 (13.1)	11.1 (19.4)	3
Acephate 75 SP	800	8.4 (16.8)	5.2 (13.2)	10.9 (19.3)	3
Control		9.8 (18.2)	7.8 (16.2)	16.2 (23.7)	2.5
CD @ 5%		1.15	1.29	2.24	0.5

Data in the parenthesis are angular transformed values.

Table 63. Evaluation of fungicides and botanical products against rice blast disease.

Fungicide	Dosage / litre	Foliar blast (%)	Transformed angular values	Grain yield (t / ha)
Metaminostrobin 20 SC (50)	0.5 ml	5.5	13.5	0.8
Metaminostrobin 20 SC (100)	1 ml	6.5	14.7	0.8
Metaminostrobin 20 SC (200)	2 ml	7.3	15.6	0.7
Tricyclazole 75 WP (Beam)	0.6 g	8.5	16.9	0.6
Isoprothiolane 40 EC (Fujione)	1.5 ml	9.5	17.9	0.9
Propiconazole 25 EC (Bumper)	1 ml	5.8	13.9	0.6
Check (untreated; sprayed with equal quantity of distilled water)	-	80	63.5	0.2
Ocimum sanctum ethanolic extract (0.1%)	0.1%	2.25	8.72	1
Ocimum sanctum steamed aqueous extract	0.1%	2	8.13	1
Aegle marmelos ethanolic extract	0.1%	3.5	10.78	1.1
Aegle marmelos aqueous extract	0.1%	2.75	9.63	1.2
Ethanolic check	0.1%	80	63.44	0.2
CD (0.05)		2.4		216.9

Insecticide Evaluation Trial

Eight formulations of insecticides were tested against insect pests of rice during *kharif* 2009. The results are in Table 62.

Evaluation of New Molecules of Fungicides and Botanical Product against Rice Blast Disease

Spraying of four molecules of fungicides Metominostrobin 20 SC, Tricyclazole 75 wp, Isoprothiolane 40 EC, and Propiconazole 25 EC were done thrice along with eight other botanical products-based treatments at an interval of nine days each on a blast susceptible rice variety HR 12. All the treatments did significantly reduce the foliar blast than the untreated check. Among the fungicides Metaminostrobin 20 SC (50) was the most effective. In case of botanicals *Ocimum sanctum* steamed extract was most effective. The results are in Table 63.

Identification of Effective Botanicals and Evaluations along with Nutrients and Chemicals for Management of Brown Spot

The trial was conducted in an unbunded upland soil using susceptible RR 267-9. Results (Table 64) reveal that plant extracts had potential to control brown spot under field condition. However, the chemicals were more effective but with environmental hazards. These plant extracts were non-significant with each other but was significant with the control.

URSBN

Brown Spot: In the OYT and AYT at Almora,

Table 64. Effect of plant extracts on disease intensity of brown spot and yield.

Plant extract	Dose / litre (g / litre)	Disease intensity in flag leaf (%)	Yield (t / ha)[1]
T_1 Australian grass	100	49.23	0.8
T_2 *Cynodon dactylon* with root	100	46.74	0.9
T_3 *Cynodon dactylon* without root	100	30.09	0.9
T_4 Parthenium leaf	100	35.36	0.9
T_5 Ipomea leaf	100	38.94	0.9
T_6 Lantana leaf	100	41.26	0.8
T_7 Contaf	2 ml / litre	25.75	0.9
T_8 Control		52.22	0.6
LSD at 5%		10.16	0.2

[1]Due to severe drought at tillering and flowering, the yield was drastically reduced.

Cuttack, Rewa, Ranchi, Semliguda and Hazaribag the brown spot disease severity index was higher (4.2-5.4) at Almora, Hazaribag and Rewa. It was lower (2.6-3.5) at Semliguda and Cuttack. Entries IR 82635-B-B-82-2, IR 82638-B-B-147-1, IR 82589-B-B-13-3, IR 82635-B-B-75-2, IR 82639-B-B-115-1, RR 429-1, IR 82589-B-B-121-3, IR 82589-B-B-124-2 and RR 417-B-68-B-1-1-2-B were tolerant with scores of 2 or 3. Susceptible check (Benibhog) had scores of 8 or 9, whereas the resistant check (Ch 45) scored 3 in these locations.

In AYT of 100 days, entries IR 78908-193-B-3-B ,IR 81025-B-311-B, IR 83867-B-B-250- CRA-1-1, IR 83931-B-B-302-CRA-2-1, RR 616-B-2-75-1, IR 84898-B-171-CRA-43-1, RR498-5-1-1-1, RR 616-B-2-75-2, IR 83934-B-B-247-CRA-1-1, NDR 1131and RR 616-B-2-66-4 exhibited tolerant reaction (3.2-3.8) parallel to resistant check CH 45 (3.8) at Hazaribag, Almora, Rewa, Cuttack and Semiliguda.

Bacterial Blight: Fiftyfive entries were screened in rainfed shallow lowlands at Hazaribag. The entries were transplanted and at the time of maximum tillering these were inoculated with bacterial suspension of local isolate. The disease score was taken 15 days after inoculation. Observation on disease score indicated that entries IR 78908-193-B-3-B, RR 506-3, IR 81025-B-311-B, NDR 1030-1, PB 26 and BAU 438-06-4 exhibited tolerant reaction with score of 1-2, whereas the susceptible check (TN 1) had a score of 7. IR 78908-193-B-3-B, IR 81025-B-311-B and NDR 1030-1 had multiple resistant reaction (with scores of 3.2 and 1, respectively) against both brown spot and bacterial blight.

Participatory Varietal Selection under Drought Breeding Network: PVS in villages Nagwan, Dundhwa and Lupung were done during the last week of Oct 2009 and the first week of Nov 2009 for drought-tolerant genotypes of less than 120 days duration, organized under the ICAR-IRRI collaborative Drought Breeding Network activities. Apart from Sahbhagi Dhan that was selected consistently by farmers across all the villages, the other selections were IR 74371-54-1-1 and IR 78908-193-B-B. Genotypes R-RF 23 and IR 83614-281-B were selected by all farmers in village Lupung.

Socio-Economic Research for Sustainable Development

Participatory Extension and Training Methodology Development for Various Groups

Assessment of Effectiveness of KVK Programme on Sustainable Development of Farmers

The study was conducted in KVK adopted villages of Sanimula and Bartira and non-adopted villages of Pubapada and Ranitola in Jagatsinghpur district of Orissa. Twenty-five farmers were randomly selected from each village constituting a fixed sample size of 100. The results are in Tables 65 to 71.

Gender Issues in Rice Farming

Income Generating Opportunities for Tribal and Disadvantaged Farmwomen through Entrepreneurship Development on Rice-Based Farming System

The findings regarding correlation between 10 independent variables and involvement of the respondents in rice-based farming activities revealed that age, education, occupation, land-holding, farm power and income were negatively and significantly associated with the involvement of farmwomen in rice-based farming activities.

Results on the extent of influence in decision-mak-

Table 65. Analysis of training methodology.

Criteria	Very well adopted	Well adopted	Little adopted	Mean score
Based on needs of trainees	34	12	4	2.6
Training plan drawn on with the involvement of trainees	17	23	10	2.1
Due weightage to the questions and reaction of the participants	25	21	4	2.4
Illustration and example drawn from society	14	27	9	2.1
Highly interactive	31	14	6	2.5
Provision for practice	21	23	6	2.3
Communication simple, more use of local language, interest stimulating, use of audio visual aids	28	17	5	2.5
Evaluation	11	21	8	1.66
Participatory Index = 0.7.				

Table 66. Distribution of the respondents on the basis of their knowledge level in different components of crop cultivation technologies.

		KVK trainees[1]		Non-trainees[1]		
Category	Score	Frequency and percentage	Mean score	Frequency and percentage	Mean score	't'-value
High achiever	60 and Above	15; 30	64.7	2; 4	30.2	3.8[2]
Moderate achiever	40-59	26; 52		19; 38		
Low achiever	Less than 40	6; 12		29; 58		

[1]N=50. [2]Significant at 0.01 level of probability.

Table 67. Relationship between socio-personal, psychological and economic variables with the knowledge level of farmers.

	Beneficiaries		Non-beneficiaries	
Independent variables	'r'	't'	'r'	't'
Age	0.34	2.5[1]	0.077	0.53 [NS]
Education	0.419	3.19[1]	0.091	0.1 [NS]
Family type	0.08	0.55[NS]	0.087	0.32 [NS]
Social participation	0.298	2.16[1]	0.059	0.4 [NS]
Risk bearing preference	0.121	0.84 [NS]	0.099	0.61 [NS]
Economic motivation	0.185	1.39 [NS]	0.155	1.08 [NS]
Land holding	0.16	1.12 [NS]	0.116	0.8 [NS]
House type	0.188	1.32 [NS]	0.073	0.5 [NS]
Farm power	0.288	2.08[1]	-0.107	-0.74 [NS]
Material possession	0.053	0.36 [NS]	-0.228	-1.37 [NS]
Family income	0.305	2.22[1]	-0.208	-1.63 [NS]

[1]Significant at 0.01 level of probability.

Table 68. Distribution of the respondents on the basis of their adoption level in different components of crop cultivation technologies.

		KVK trainees[1]		Non-trainees[1]		
Category	Score	Frequency and percentage	Mean score	Frequency and percentage	Mean score	't'-value
High	27 and Above	11; 22	24.52	2; 4	14.14	2.7[2]
Medium	18-26	33; 66		17; 34		
Low	Less than 18	6; 12		31; 62		

[1]N=50. [2]Significant at 0.01 level of probability.

Table 69. Extent of adoption of crop cultivation technologies.

Cultivation technologies	Mean score	Rank
High-yielding variety of major crops	2.72	I
Nursery management practices	2.34	VI
Transplanting techniques	2.1	VIII
Balanced use of fertilizer in crops	2.62	III
Water management practices of major crops	1.98	X
Seed treatment	1.16	XVII
Chemical weed control	1.12	XVIII
Use of improved farm implements	1.7	XI
Post-harvest technology	1.4	XIII
Planting techniques of tuber crops	1.02	XX
Cultivation aspects of green manuring crops	2.06	IX
Seed production in paddy	2.66	II
Collection of soil samples and testing	1.22	XVI
Chemical methods of pest control	2.6	IV
Mushroom cultivation	2.42	V
Food preservation practices	1.64	XII
Tissue culture banana	1.3	XV
Kitchen gardening	2.16	VII
Rhizobium treatment in pulse crops	1.36	XIV
Vermi-compost preparation	1.06	XIX

Table 70. Relative importance of the areas of training programmes in crop cultivation technologies.

Training programmes	Mean score[1]	Rank
Soil testing	2.54	VII
Water management in crops	2.26	XIV
Nutrient management	2.6	VI
Bio-fertilizer	2.5	VIII
Package of practices of commercially important HYVs of rice	2.82	I

(continued)

Table 71. Relative importance of areas of training programmes in crop cultivation technologies (concluded).

Training programmes	Mean score[1]	Rank
Cultivation of high-yielding vegetables and fruits	2.76	II
Plant protection measures in crops, vegetables and fruits	2.7	III
Green manuring	2.4	XI
Post-harvest technology	2.38	XII
Preservation and processing of vegetables and fruits	2.68	IV
Use of improved agricultural implements	2.34	XIII
Mushroom cultivation	2.64	V
Tissue culture banana	2.46	IX
Kitchen gardening	2.42	X
Vermi-compost preparation	2.14	XV

[1]Scored in 3 point rating scale.

ing related to farm management, showed that men took independent decisions or were dominated by them, except in "selling surplus farm produce," "borrowing money for farm operations" and "introducing a new crop variety" (Tables 72 and 73).

Table 72. Correlation and multiple regression between independent variables and involvement of the respondents in rice-based farming activities.

Independent variables	'r'-value	'b'-value	S-error	't'-value
X_1 Age	-0.5087[1]	-0.2277	0.0497	-4.58[1]
X_2 Education	-0.3063[1]	-0.3156	0.0443	-7.12[1]
X_3 Occupation	-0.2484 [1]	0.2059	0.0472	-4.36[1]
X_4 Family type	-0.0725 [NS]	-0.0879	0.0594	-1.48 [NS]
X_5 Land-holding	-0.5173[1]	0.0157	0.0718	0.22 [NS]
X_6 Farm power	-0.6112[1]	-0.0605	0.0699	-0.87 [NS]
X_7 Material possession	-0.0780 [NS]	-0.0317	0.0809	-0.39 [NS]
X_8 Social participation	-0.0491 [NS]	-0.0591	0.0399	-1.48 [NS]
X_9 Income	-0.6571[1]	-0.4955	0.0727	-6.82[1]
X_{10} Urban contact	0.0283 [NS]	0.0253	0.0350	0.72 [NS]

[1]Significant at 0.01 level of probability; R^2=0.873; Fcal.=90.99** at d.f. 10, 189; NS=Non-significant.

Table 73. Involvement of farmwomen in decision-making related to farm management (N=200).

Areas of decision-making	Extent of influence					Mean score	Rank
	Only women	W>M	W=M	M>W	Only men		
Introducing a new crop variety	18 (9)	23 (11.5)	34 (17)	64 (32)	61 (30.5)	2.36	III
Borrowing money for farm operations	14 (7)	21 (10.5)	39 (19.5)	77 (38.5)	49 (24..5)	2.37	II
Buying farm equipments / machinery	10 (5)	14 (7)	41 (20.5)	81 (40.5)	54 (27)	2.22	IV
Quantity and type of fertilizers to be used	0 (0)	5 (2.5)	26 (13)	27 (13.5)	142 (71)	1.47	VIII
Adopting new farm practices	0 (0)	6 (3)	37 (18.5)	55 (27.5)	102 (51)	1.73	V
Selection of seeds	0 (0)	3 (1.5)	39 (19.5)	17 (8.5)	141 (70.5)	1.52	VII
Irrigation management	0 (0)	4 (2)	39 (19.5)	55 (27.5)	102 (51)	1.72	VI
Plant protection measures	0 (0)	3 (1.5)	18 (9)	41 (20.5)	138 (69)	1.43	IX
Selling surplus farm produce	48 (24)	43 (21.5)	51 (25.5)	36 (18)	22 (11)	3.29	I

Ravi Viswanathan

Krishi Vigyan Kendras

Santhapur

Training

Seventeen off- and on-campus vocational training programmes were organized for 490 farmers / farm women / rural youths. The programmes were on "Scientific Method of Vegetable and Fruit Preservation," "Entrepreneurial Development of Farmers / Rural Youth," "Group Dynamics," "Diseases Management of Dairy Animals," "Feed and Fodder Management of Dairy Animal," "Formation and Management of Self-help Groups," "Leadership Development," Care and Management of Dairy Animals," Integrated Farming System (Rice + Fish)," Identification of Pests and Diseases of Rice and their Natural Enemies under Field Condition," "Integrated Weed Management," "Vermicomposting," "Integrated Farming System," "Dairy Management," and "Backyard Poultry Rearing and Organic Farming."

A total of three in-service trainings were conducted on "Team building, Capacity Building of Para-veterinarians on different Animal Husbandry Activity and Vermicomposting."

A total of six sponsored trainings were conducted on "Organic Farming," "Vermicomposting and Capacity Building of Youth for Social Sector." These were organized by NGO, Navajyoti, Garudagano, DDH, Cuttack, DDH, Athagarh and NGO, Digbalay Nehru Yuva Kendra Sangathan, Cuttack.

Frontline Demonstrations

In *kharif* 2009 FLD in rice was conducted. The performance is given in Table 74.

Urdbean: FLD in variety PU 30 was conducted in 5 ha in Nandol, Jhadeswarpur, Satyabhamapur, Tangi, Uchapada, Bainpur and Govindpur benefiting 25 farmers. The average yield recorded in demonstrated plot (0.5 t / ha) was 53% higher than the local check T9 (0.3 t / ha). The average net returns in demonstrated plots was ` 15,500 / ha with B : C ratio of 1 : 3.47, whereas in the local check, it was ` 11,000 / ha with B : C ratio of 1 : 2.83.

Groundnut: FLD was conducted during *kharif* 2009 and *rabi* 2009-10 in 5 ha with JAL 42 and TMV 2 in Haridapal of Tangi-Choudwar block, and Guali of Salipur block. In *kharif* JAL 42 yielded 2 t / ha that was 42.6% higher than the local AK 12-24 (1.4 t / ha). The average net returns in demonstrated plots were `43,200 with B : C ratio of 1 : 3.4, whereas it was ` 26,900 with B : C ratio of 1 : 2.68, respectively in AK 12-24.

On-farm Trials

OFT on Khaki Campbell ducks were tested in field condition by providing 50 g starter broiler feed / bird up to one month followed by finisher broiler ration up to three months. Results showed that 22 eggs / bird / month were laid by Khaki Campbell compared to 10 eggs / bird / month by the local variety. The weight of the egg of Khaki Campbell was 65 g compared to 52 g of the egg of the local.

Pusa Krishi Vigyan Mela

The KVK, Santhapur sponsored the visit of five farmers' from adopted villages to the Pusa Krishi Vigyan Mela at the Indian Agricultural Research Institute (IARI), ICAR, Pusa, New Delhi from 4 to 6 Mar 2010. The farmers Shri R.C. Swain of Bainpur, Mahanga, Shri Bhakta Praharaj of Jhedeswarpur, Mahanga, Shri Nakula Sahu of Khetrapala, Tangi, Shri Amulya Majhi of Mania, Tangi and Shri Harihar Pattnaik of Uchhapada, Tangi were accompanied by Dr P.K. Mallick, SMS of the KVK. The farmers were exposed to various technologies at the Mela. They also visited the National Science Museum in the NASC Complex, New Delhi.

Table 74. Performance of rice in FLD.

Variety	Area(ha)	Number of demonstrations	Critical inputs	Yield (t/ha)	Net returns (`/ha)	B : C ratio
Anjali	2	12	Seeds	3.1	18,087	1 : 1.87
Naveen	2	15	Seeds,Vitavax	3.6	20,823	1 : 2.2
Satyakrishna	0.8	6	Seeds,Vitavax	3.8	23,577	1 : 2.27
Chandan	2	11	Seeds,Vitavax	4	26,110	1 : 2.41
Pooja	2	13	Seeds,Vitavax	4.6	29,998	1 : 2.46
Gayatri	2	9	Seeds,Vitavax	5.5	40,496	1 : 2.97
Sarala	1.6	12	Seeds	4.7	31,214	1 : 2.52
Durga	0.8	6	Seeds,Vitavax	4.5	29,556	1 : 2.44
Varshadhan	0.5	5	Seeds,Vitavax	4.1	22,544	1 : 2.1
Ketekijoha	0.8	8	Seeds,Vitavax	3.2	31,060	1 : 2.55
Geetanjali	0.8	6	Seeds,Vitavax	3.2	32,030	1 : 2.6
Nua Dhusara	0.8	8	Seeds,Vitavax	3	28,494	1 : 2.42

Jainagar, Koderma

Training

Training programmes were conducted on different topics in plant protection, human empowerment for farmers, farmwomen and rural youths. These were "Plant Protection in Okra," "Vaccination Schedule of Broiler," "Lac Cultivation," "Value Added Food Production (Cereals and Pulses)," "Improved Balanced Diet for Adolescent Girls," "Care and Management of Milch Cattle during Summer," "Seed Treatment in Rice," "Seed Treatment in *kharif* Pulses," "Development of Nutritious Diet for School going Children," "Vaccination Schedule of Cattle for Protection from Common Diseases (HS, BQ and FMD)," "Control of Ecto- and Endo-parasite Infestation in Cattle and Goat," "Identification and Management of Rice Insect Pests and Diseases," "Embroidery, Storage of Foodgrain in Local Condition," "Pest Management for Safer Environment," "Identification and Management of Insect Pests and Diseases of Urdbean and Pigeonpea," "Computation of Balanced Ration for Milch Cattle," "Cloth Painting," "Simple Painting," "Spray Painting and Block Printing," "Safe Use of Pesticides and First Aid Precautions," "Drudgery Reduction in Farm Operation for Farm Women," "Care and Management of Broiler," "Seed Treatment of Cereals," "Oilseeds and Pulse crops," "Incorporation of Mineral Mixture in Cattle Ration," "Preparation of Mixed Vegetable Pickles," "Storage of Foodgrain in Local Condition," "Cultivation of Oyster Mushroom in Poly Bag," "Identification and Management of Insect Pests and Diseases of Rapeseed and Mustard," "Control of FMD in Cattle," "Care and Management of Cross Breed Calf," "Identification and Management of Insect Pests and Diseases of Chickpea," "Identification and Management of Insect Pests and Diseases of Wheat," "Care and Management of Newly Born Kids," "Awareness about Nutritional Garden," "Preservation of Mixed

Table 75. Extension activities organized by the KVK, Koderma.

Activities	Number	Beneficiaries
Field day	2	500
Kisan Gosti	4	455
Radio talks	6	-
TV talks	15	-
Advisory Services	115	-
Scientific visit to farmers field	-	901
Farmers' visit to KVK	-	1,134
Animal health camp	1	82
Animal vaccination camp	2	150
Poultry vaccination	1	25
Technology week	1	171

Vegetable Pickles," "Upgradation of *Desi* Cow," "Care and Management of Duck," "Care and Management of Duck," "Plant Protection in Cucurbits," "Common Diseases of Goat and its Control," "Identification and Management of Insect Pests and Diseases of Mungbean," and "Stitching of Clothes."

A total of nine sponsored training programmes were conducted. These were on "Seed Treatment," "Soil Testing," "Crop Diversification," "Scientific Diary Farming," "Insect Pest Management in *Rabi* Crops" and "Scientific Cultivation of *Rabi* Crops" by the ATMA, Koderma, "Oyster Mushroom Technique," "Artificial Insemination and Dairy Cattle," "Care and Management of Cross Breed Heifer by SBI, Koderma and SHG training by SGSY.

On-farm Trials

Okra: Improved practice of spread of methyl demeton @ 1.5 ml/litre water reduced pest incidence and enhanced yield by 1.6 t/ha over farmers' practice. The B : C was 1 : 6.82 with net returns of ` 91,350/ha.

Chickpea: Application of Endosulphan @ 2.5 ml/litre water over farmers' practice gave 0.5 t/ha higher yield than *desi* chickpea. The B : C was 1 : 3.28 with net returns of ` 34,154/ha.

Fieldpea: A higher yield of 1.5 t/ha was obtained in fieldpea Swarna Priya by treating seed with Bavistin (Carbendazim) @ 2 g/kg seed over farmers' practice. The B : C was 1 : 5.96 with net returns of ` 70,120/ha.

Potato: Application of 60 kg K instead of 30 kg K in Kufri Bahar resulted in higher yield of 1.9 t/ha over farmers' practice. The B : C was 1 : 6.27 with net returns of ` 98,340/ha.

Pigeonpea: Use of Bavistin (Carbendazim) @ 2.5 g/kg seed over farmers' practice gave higher yield of 1.9 t/ha. The B : C was 1 : 4.8 with net returns of ` 42,680/ha.

Aonla: Use of aonla + sugar + lime improved valuable addition. Use of sterilized container for preserving murraba gave year long nutritional security.

Heifers: Improvement of whitening/mineral seed supplement, phosphorus and anti-helmenthic medication increased fertility than farmers' practice. The B : C was 1 : 1.66 with net returns of ` 72,000.

Sarcoptic Mange in Calf: Use of Ivermectin @ 1 ml/20 kg improved the health status and reduced the calf mortality.

Frontline Demonstrations

Rice Anjali yielded 53.6% higher than the local check in *Zaid* 2009 in farmers' field. The B : C was 1 : 1.6 with net returns of ` 6,095/ha.

In *Zaid* 2009 rice Hazaridhan gave 62% more yield than the local check in farmers' field. The B : C was 1 : 1.85 with net returns of ` 8,884/ha.

A 10% increase in yield was obtained with rice Abhishek during *kharif* 2009. The B : C was 1 : 2.01 with net returns of ` 11,310/ha.

Birsa Niger grown in *kharif* 2009 under rainfed conditions gave 43% higher yield than the local. The B : C was 1 : 3.58 with net returns of ` 13,932/ha.

Toria T 9 in *rabi* 2009-10 yielded 30% more than the local. The B : C was 1 : 1.82 with net returns of ` 5,301/ha.

Mustard Pusa Jai Kishan yielded 32% more than

the local in *rabi* 2009-10. The B : C was 1 : 3.17 with net returns of ` 17,711 / ha.

Linseed Parvati gave net returns of Rs 8,267 / ha with a B : C of 1 : 2.48 in *rabi* 2009-10 in irrigated farmers' field. The increase in yield was 58% over the local.

Chickpea Vijaya yielded 22% more than the local with net returns of ` 32,040 / ha with a B : C of 1 : 3.06.

Lentil BPL 62 yielded 39% more than the local with a B : C of 1 : 3.52. The net returns was ` 25,723 / ha.

A net return of ` 29,849 / ha was obtained in wheat HD 2888 and mustard Pusa Jai Kishan mixed cropping, and pest management in irrigated conditions in *rabi* 2009-10.

Wheat HP 2888 sown in zero tillage in irrigated conditions in *rabi* 2009-10 gave 22% more yield with net returns of ` 35,672 with a B : C of 1 : 4.62.

Poultry: Divyan Red attained a weight of 1.3 kg in six months than the native poultry of the farmer that attained 1 kg. The survival was 90% in Divyan Red after six weeks compared to 75% in the native.

Duck: Khaki Campbell attained a weight of 1.6 kg in six months compared to 1.1 kg in the farmers' desi duck. The survival up to six weeks was 95% with Khaki Campbell compared to desi duck.

Zero Till Transforms Cultivation in Village Bansidih of Koderma

MY life and the remuneration to my family has increased to more than Rs 30,000, in one season by using the zero tillage machine for sowing wheat, chickpea, mustard and linseed," said Shri Munshi Mahato, a progressive farmer in village Bansdih, Block Markachho of District Koderma in Jharkhand. He was implementing the zero tillage technique under the guidance of the CRRI KVK, Jainagar, Koderma. The KVK has been conducting various training programmes on zero till from 2007 onwards. Although, there was initial resistance to the movement from the conventional method to the zero till method but farmers in 2009 moved towards zero till technology of sowing the crops. The farmers have been purchasing a zero till-seed-cum-ferti drill machine. The Department of Agriculture, Jharkhand has been providing a 50% subsidy on the machine. The zero till technology has not only reduced the cost of land preparation and labour wages but also saved irrigation water, gave a higher input efficiency, and advanced the sowing than in the conventional method. Shri Mahato is now educating other farmers on the zero till technology.

KVK, Koderma

Publications

Research Papers

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RAC, IJSC, SRC and SAC Meetings

Research Advisory Committee

The XV Meeting of the Research Advisory Committee (RAC) was held at the Central Rice Research Institute, Cuttack from 11 to 12 Nov 2009. The following members were present:

Dr R.K. Singh ..... Chairman
Dr B. Vidyachandra ..... Member
Dr Karabi Datta ..... Member
Dr A.P.K Reddy ..... Member
Dr S.K. Sharma ..... Member
Dr T.K. Adhya ..... Member
Dr S.N. Shukla ..... Member
Dr S.S. Rahangdale, Representative of Agricultural / Rural Interest ..... Member
Shri Digambar Mohapatra, Representative of Agricultural / Rural Interest, ... Member
Dr R.N. Rao ..... Member-Secretary

Dr B.C. Viraktamath, Project Director, Directorate of Rice Research, Hyderabad and special invitee of the Chairman, RAC could not participate in the meeting.

The Chairman with the Members conducted a premeeting briefing followed by an open session. The CRRI should further strengthen research to adapt rice growing to climatic changes, conservation agriculture including crop establishment methods, new agronomy and breeding to meet the emerging challenges due to shortage of water and labour, and the increasing cost of cultivation" said Dr R.K. Singh. Dr T.K. Adhya presented the highlights of the research achievements and infrastructural developments since the last RAC meeting. Dr R.N. Rao presented action taken report on the recommendations of the XIV RAC. Dr D.P. Sinhababu, Member Secretary, Staff Research Council (SRC) highlighted the salient features of the programme of work approved by the SRC 2009–10 as well as for the externally aided projects (EAPs). The RAC Members also visited field experiments and research laboratories.

Institute Joint Staff Council

The 6th IJSC meeting was held on 18 Jun 2009 at CRRI, Cuttack. The following were present:

Dr T.K. Adhya, Director ..... Chairman
Dr A.K. Mishra, Principal Scientist ..... Member
Dr Anand Prakash, Principal Scientist .... Member
Shri S.K. Sinha, SAO ..... Member
Shri P.C. Naik, I/c FAO ..... Member
Shri S.K. Mathur, AAO ... Secretary (Official Side)
Shri D.K. Parida ..... Member
Shri Satyabrata Nayak ..... Member
Shri S.C. Pradhan ..... Member

B. Behera

Shri Arun Panda ..... Member and
..... Secretary (Staff Side)
Shri S.K. Ojha ..... Member
Shri B.B. Das ..... Member
Shri B.K. Behera ..... Member

Dr S.N. Tewari, Principal Scientist and Member could not attend the meeting.

The Proceedings and action taken report of the 5th IJSC was approved. Various administrative and financial issues were discussed.

Staff Research Council

Meetings: The 24th meeting was held from 18 to 21 May 2009 and 1 Jun 2009. The objectives were to discuss the results of *rabi* 2007-2008 and *kharif* 2008.

The 25th meeting was held from 2 to 4 Dec 2009 with the objectives of finalizing the work plan for *rabi* and *kharif* 2010.

Field Visits: The Chairman and Members of the SRC visited field trials and activities in net-houses of the projects at CRRI, Cuttack on 1 Apr 2009 and again from 23 to 27 Oct 2009.

Scientific Advisory Committee of Krishi Vigyan Kendras

KVK, Santhapur

The XI Scientific Advisory Committee Meeting of the KVK, Santhapur was held on 29 Mar 2010 at Santhapur. The following were present:

Dr T.K. Adhya, Director, CRRI, Cuttack ..... Chairman
Shri P.K. Dash, DDA, Cuttack ..... Member
Dr R.C. Behera, CDVO, Cuttack ..... Member
Shri R.K. Mohapatra, Lead Bank Manager, Cuttack ..... Member
Shri S.K. Mohapatra, ADFO, O/O DDF. Cuttack ..... Member
Shri P.C. Swain, AHO, O/O DDH, Cuttack ..... Member
Shri Durga Majhi, Farm Radio Officer, Cuttack ..... Member
Shri S.K. Sahoo, DD Representative, BBSR ..... Member
Shri Bhakta Praharaj, Farmer Representative, Jhadeswarpur, Mahanga ..... Member
Representative, Satyabhamapur, Salipur ..... Member
Smt Pramila Ojha, Lady Farmer Representative, Mania, Tangi-Choudwar ..... Member
Smt Nirmala Das, Lady Farmer Representative, Buhalo, Nischintkoili .... Member
Dr S.M. Prasad, Senior Scientist and OIC, KVK, Cuttack ..... Member-Secretary

Dr S.M. Prasad presented the progress report of from Apr 2009 to Mar 2010. Dr J.R. Mishra presented the Action Plan from Apr 2010 to Mar 2011. This was followed by interaction among the Members of various line departments, farmers representatives, invited guests and KVK scientists for future course of action.

KVK, Jainagar, Koderma

The SAC was held at KVK, Jainagar, Koderma, Jharkhand on 22 Feb 2010, under the Chairmanship of Dr M. Variar, Officer-in-Charge, CRURRS, Hazaribag. Col. Binoy Kumar, Specialist in Low-cost Agro-techniques was the Special Guest

The meeting was also attended by all the scientists of CRURRS, Hazaribag and representative of line department of Koderma district, Dr Shabbeer Ahmed, DD, BAU, Ranchi, Shri G. Thakur, DDM, NABARD, Koderma, Shri Anand Kumar, Deputy Manager, PPL, Koderma and farmers representatives Shri Malti Chandra, Shri Ramchandar Mahato, Smt. Lakshmi Devi, Smt. Manju Devi, Dr V.K. Singh, PC and all the SMS and Programme Assistants of KVK.

The progress report for 2009-2010 and Annual Action Plan for 2010-2011 were discussed.

Participation in Symposia/Conferences/Workshops/ Training in India and Abroad

DR S.R. Dhua attended the Annual Group Meeting of NSP (Crops) at TNAU, Coimbatore from 2 to 4 Apr 2009.

Dr T.K. Adhya attended the NAIP Annual Meeting at IVRI, Bareilly from 14 to 15 Apr 2009.

Dr P. Samal attended the training workshop on "Date Management for Household Surveys" under the IRRI collaborative project on "Stress-tolerant Rice for Poor Farmers in Africa and South Asia" at OUAT, Bhubaneswar from 14 to 16 Apr 2009.

Dr T.K. Adhya attended the INSA Sectional Committee Meeting at New Delhi from 28 to 30 Apr 2009.

Dr K.S. Rao attended the policy dialogue workshop on "SRI" held at ANGRAU, Hyderabad on 4 May 2009.

Dr P. Kaushal attended the training on "Agricultural Biotechnology" at the Institute of Plant Genetic Perugia, CNR, Italy from 5 May to 4 Nov 2009 under the DBT Overseas Associateship Award.

Drs G.J.N. Rao, K.S. Rao, S.G. Sharma, S.R. Dhua, R.N. Rao, O.N. Singh, J.N Reddy, S.K. Pradhan, R.K. Sarkar, Padmini Swain, K.M. Das, Mayabini Jena, Sanjukta Das and Shri R.C. Dani attended the 44th All-India Annual Rice Group Meeting at DRR, Hyderabad from 9 to 12 May 2009. Dr T.K. Adhya attended it from 10 to 12 May 2009. Dr Mangala Rai, Secretary, DARE and Director-General, ICAR, released two *CRRI Technology Bulletin* namely "Production Technology for Deepwater Rice" and "Integrated Management of Rice Storage Insects" in English and Hindi.

Dr Sanjoy Saha delivered a talk on "Agro-tech-

Dr Mangala Rai releases the *CRRI Technology Bulletins*.

Courtesy: DRR, ICAR, Hyderabad

niques for Sustaining Productivity of Wet Direct-sown Summer Rice in Flood-prone Lowlands" as Invited Guest Speaker in the National Symposium on "Agriculture in the Paradigm of Intergenerational Equity" by the Crop and Weed Science Society, West Bengal on 23 May 2009.

Dr T.K. Adhya attended the NAAS General Body Meeting and Foundation Day programme at NASC, New Delhi from 4 to 5 Jun 2009.

Dr Arun Pandit attended the Summer School on "Entrepreneurship Development under Sustainable Farming System" at the ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok from 25 May to 14 Jun 2009. Dr G.A.K. Kumar conducted sessions on "Risk Taking Behavior", "TAT on Entrepreneurial Qualities" and "Who am I" during the Summer School.

Drs T.K. Adhya, P.K. Sinha, M. Variar, and D.P. Singh attended the 8th Annual Meeting of the CURE Steering Committee at Hanoi, Vietnam from 27 to 29 May 2009. The meeting assessed the progress in rice research in unfavourable ecosystems in terms of crop improvement, natural resource management and outscaling, and to review potential future directions, initiatives, partnerships and linkages for the unfavourable rice environments. Besides delegates from CRRI others were CURE Steering Committee members, scientists from Vietnam and six countries, Representatives of the International Fund for Agricultural Development (IFAD) and Australian Centre for International Agricultural Research (ACIAR) and scientists from the IRRI, the Philippines. CURE focuses on rice farming systems where low and unstable yields are prevalent and is guided by a Steering Committee composed of representatives from the National Agriculture Research and Extension Systems (NARES) from member countries.

Dr G.A.K. Kumar attended the launch workshop of NAIP project on "Development and Maintenance of Rice Knowledge Management Portal" at DRR, Hyderabad from 16 to 17 Jun 2009.

Drs T.K. Adhya and P. Mishra attended a meeting on "Improving the Milling Quality of Summer Rice in Chhattisgarh" at IGKVV, Raipur on 19 Jun 2009.

Dr A.K. Shukla attended the Council Meeting of the Indian Society of Soil Science as a representative of east zone, at IARI, New Delhi, from 19 to 20 Jun 2009.

Dr T.K. Adhya attended the 9th Agricultural Science Congress at the University of Agricultural Sciences and Technology, Sher-e-Kashmir, Srinagar from 22–24 Jun 2009.

Dr T.K. Adhya attended the 53rd meeting of the Central Sub-Committee on Crop Standards, Notification and Release of Varieties at Krishi Bhavan, New Delhi on 26 Jun 2009.

Dr Pramila Krishnan availed USEFI Fulbright Senior Research Fellowship programme 2009–10 from 8 Jul 2009 to 13 Jan 2010.

Dr T.K. Adhya attended the ICAR Award Ceremony and the Director's Meeting at New Delhi on 16 Jul 2009. He also attended the National Meeting on Conservation of Agriculture at ICAR, New Delhi on 18 Jul 2009.

Dr P. Samal attended the National Seminar on "New Vision in Agricultural Marketing—Planning, Designing of Agricultural Markets and Linking to Producers" at OUAT, Bhubaneswar on 18-19 Jul 2009.

Dr T.K. Adhya attended a meeting with Dr Bill Gates to discuss the issue of promotion of stress-tolerant varieties particularly Swarna-*Sub1* under the Bill & Melinda Gates Foundation supported projects such as "Stress Tolerant Rice for Poor Farmers in Africa and South Asia (STRASA)," under the ICAR-IRRI collaborative project at New Delhi on 23 Jul 2009. Dr T.K. Adhya presented the progress in the projects.

Dr D.P. Sinhababu attended a meeting with the Principal Secretary, Department of Fisheries and ARD, Government of Orissa at the Directorate of Fisheries, Cuttack on 23 Jul 2009. He delivered a lecture on "Rice-fish Integrated Farming System."

Dr T.K. Adhya attended the programme finalization workshop for the All-India Network Programme on "Biofertilizer and Biodiversity" at CRIDA, Hyderabad on 25 Jul 2009.

Dr Sanjoy Saha attended the Annual Review Meeting of NIWS at the TNAU, Coimbatore on 1 Aug 2009.

Dr Sanjoy Saha participated in the National Sym-

posium on "Weed Threat to Environment, Biodiversity and Agricultural Productivity" at the TNAU, Coimbatore from 2 to 3 Aug 2009. He presented a paper on "Bio-intensive Weed Management in Direct-sown Rainfed Lowland Rice."

Dr T.K. Adhya attended the Sectional Committee meeting of INSA at New Delhi from 3 to 5 Aug 2009.

Dr N. Bhakta acted as a resource person at the farmers' training programme on "Modern Technology for Growing *Sali* Paddy" organized by the KVK, Nalbari on 4 Aug 2009.

Dr J.N. Reddy participated in the 14th APB (Australasian Plant Breeding) and 11th SABRAO (Society for Advancement in Breeding Research in Asia and Oceania) Conference jointly held at Cairns Convention Centre, Cairns, Tropical North Queensland, Australia from 10 to 14 Aug 2009. He also presented a paper on "Improvement of Rice Germplasm for Rainfed Lowlands of Eastern India" in the conference.

Dr K.S. Rao attended the SAC meeting of the KVK, Kendrapara on 19 Aug 2009.

Dr K.S. Rao attended the "SRI as a Socio-technical Movement in India" Planning Workshop at the Xavier Institute of Management, Bhubaneswar on 20 Aug 2009.

Dr S.R. Dhua attended the Review Meeting of "Seed Production in Agricultural Crops" at NASC Complex, New Delhi during 24-25 Aug 2009.

Dr T.K. Adhya attended the CURE Workshop and presented the situation report and the Work Plan of the Working Group 3 (Salt-affected Environments).The Inception Workshop on "Enabling Poor Rice Farmers to Improve Livelihoods and Overcome Poverty in South and Southeast Asia through CURE", from 26 to 27 Aug 2009 at IRRI, the Philippines. The participants were from Bangladesh, Cambodia, India, Indonesia, Lao PDR, Myanmar, Nepal, Vietnam, and the Philippines. Representatives from the IFAD and IRRI also deliberated in the Workshop.

Dr R.K. Sarkar participated in a National Symposium on "Frontiers in Photobiology" at the Bhabha Atomic Research Centre (BARC), Mumbai during 24-26 Aug 2009.

Dr M. Variar attended the Third Consortium Advisory Meeting of the NAIP project on "Allele Mining and Expression Profiling of Resistance- and Avirulence-genes in Rice-blast Pathosystem for Development of Race Non-Specific Disease Resistance" at the UAS, Dharwad from 1 to 2 Sep 2009.

Dr S.G. Sharma attended and presented a paper in the National Seminar on "Nutritional Strategies for Improving Quality of Life" at the G.B. Pant University of Agriculture and Technology, Pantnagar from 11-12 Sep 2009.

Dr T.K. Adhya attended the Sectional Committee Meeting of NAAS at New Delhi from 23 to 26 Sep 2009.

Drs P. Mishra and M. Din attended the "Training-cum-workshop for Farm Women" organized at the DRWA, Bhubaneswar on 4 Oct 2009. Dr P. Mishra delivered a lecture on "By-product Utilization and Value-addition of Foodgrains." Dr M. Din spoke on "Good Management Practices for Harvesting, Threshing and Handling of Foodgrains."

Dr O.N. Singh participated in the 3rd International Conference on "Integrated Approaches to Improve Crop Production under Drought-prone Environments" held at Shanghai, China from 14 to 17 Oct 2009.

Dr D.P. Sinhababu attended the State-level pre-seasonal orientation training for *rabi* 2009–10 during 21–22 Oct 2009 at the Directorate of Agriculture and Food Production, Bhubaneswar and delivered a lecture on "Rice-fish farming."

Dr S.R. Dhua evaluated the research experiments of the breeder seed project and seed technology for the Eastern Zone Group I of NSP (Crops) from 21 to 31 Oct 2009.

Dr T.K. Adhya attended the Orissa State Level Pre-Seasonal Orientation training for *Rabi* 2009–10 as a special invitee and delivered a talk "Prospects of Crop Production in Response to Climatic Change with Special Emphasis on Rice" at Bhubaneswar on 22 Oct 2009.

Dr N. Bhakta attended the 19th meeting of the ICAR Regional Committee Meeting No. III at Gangtok, Sikkim during 23–24 Oct 2009.

Dr T.K. Adhya attended the 54th meeting of the Central Sub-Committee on Crop Standards, Notification and Release of Varieties at Bangalore on 23–25 Oct 2009.

Courtesy: IRRI, Philippines

Delegates at the CURE meeting in IRRI get together for a group photograph.

Drs T.K. Adhya attended the National Conference on "Biodiversity Conservation and Management of Bioresources" organized by the Applied Zoologists Research Association (AZRA) at Visakhapatnam during 27–28 Oct 2009.

Dr K.S. Rao participated in the visit of NLMT in Orissa from 27 to 30 Oct 2009 as a Member of the National Level Monitoring Team of all NFSM activities constituted for Bihar, Jharkhand and Orissa by the Ministry of Agriculture, Government of India, New Delhi.

Drs G.J.N. Rao and V.D. Shukla attended the National Conference on "Biodiversity Conservation and Management of Bioresources" organized by the AZRA at Andhra University, Visakhapatnam from 28 to 29 Oct 2009.

Dr T.K. Adhya attended the Mid-term Review Meeting of the DARE for the XI Five Year Plan at CIFRI, Barrackpore at Kolkata from 29 Oct to 1 Nov 2009.

Drs K. Pande, J.N. Reddy and S.K. Pradhan attended the National Seminar on "Crops for Changing Climate" jointly organized by the Indian Society of Genetics and Plant Breeding in collaboration with the ICAR, New Delhi and the Birsa Agricultural University (BAU), Ranchi, Jharkhand at BAU, Ranchi from 30 to 31 Oct 2009.

Drs S.M. Prasad and P.K. Mallick attended the 4th National Conference of KVK-2009 held at TNAU, Coimbatore from 4 to 8 Nov 2009. Dr T.K. Adhya attended it from 4 to 7 Nov 2009. The Conference was inaugurated by Thiru M. Karunanidhi, Hon'ble Chief Minister of Tamil Nadu. Shri Sharad Pawar, Hon'ble Union Minister of Agriculture inaugurated the exhibition. Shri Sharad Pawar, Hon'ble Union Minister of Agriculture, Dr K.D. Kokate, DDG (Agricultural Extension), ICAR, New Delhi, Director (DRWA), Bhubaneswar, and the Zonal Project Directors (Zone VII and Zone II), visited the exhibit stall.

Shri Sharad Pawar, Hon'ble Union Minister of Agriculture visited the CRRI-KVK exhibit stall.

KVK, Santhapur

Dr J.N. Reddy went as a team member for monitoring the semideep and deepwater trials and AVT 2-NIL (*SUB1*) trials at the OUAT, Bhubaneswar, Chinsurah, West Bengal, Pusa, Bihar and Masodha, and Ghagharaghat, Uttar Pradesh from 4 to 10 Nov 2009.

Drs S.G. Sharma, Padmini Swain, Sanjukta Das and M.J. Baig attended the National Conference on "Frontiers in Plant Physiology towards Sustainable Agriculture" from 5–7 Nov 2009 at the Assam Agricultural University, Assam.

Dr D.P. Sinhababu delivered a lecture on "Rice-fish Farming in Asia" at the Winter School in IARI, New Delhi on 6 Nov 2009.

Dr T.K. Adhya attended the Foundation Day Ceremony of ASRB at New Delhi from 7 to 10 Nov 2009.

Dr Sanjoy Saha attended the meeting of the Area Coordinators of the NIWS Programme to discuss the "Protocols and Methodologies for Weed Survey and Surveillance" at the Directorate of Weed Science Research, Jabalpur from 13 to 15 Nov 2009.

Dr T.K. Adhya attended the Review Meeting of AMAAS Project at CPCRI, Kasargod at Mangalore from 16 to 18 Nov 2009.

Drs M. Variar and Padmini Swain participated in the 6th International Rice Genetics Symposium at IRRI, Philippines from 16 to 19 Nov 2009.

Drs S.M. Prasad, J.R. Mishra, P.K. Mallick and K. Vanitha participated in a training programme on "Mechanization and Value-addition in Rice" at CRRI, Cuttack from 18 to 23 Nov 2009 by the CRRI in collaboration with the Department of Agricultural Extension, Government of India.

Dr T.K. Adhya attended the meeting of the State Technical Committee of NFSM at OUAT, Bhubaneswar on 24 Nov 2009.

Dr S.M. Prasad presented the Annual Progress Report of 2008–09 and Action Plan of 2009–2011 in the Zonal Workshop of KVKs of Zone VII at Bilaspur from 24 to 27 Nov 2009.

Dr J.R. Mishra participated in a training programme at MANAGE, Hyderabad from 26 to 28 Nov 2009.

Dr P. Mishra delivered a talk on "Rice Milling Technology" under the programme "Campaign for Capacity Enhancement for Modern Rice Milling in Orissa" organized by the IPICOL, Orissa on 27 Nov 2009.

Drs N.C. Rath and Lipi Das attended the National Seminar on "Managing Rural Livelihood in India—Challenges and Opportunities" organized by the Orissa Society of Extension Education at the OUAT, Bhubaneswar during 27 to 28 Nov 2009.

Dr P.K. Mallick attended the Winter School of "Agri-entrepreneurship Development and Management" at CRRI from 3 to 23 Dec 2009.

Dr Lipi Das attended the National Seminar on "Women in Agriculture" organized by the International Extension Forum held at DRWA, Bhubaneswar during 4 and 5 Dec 2009.

Dr T.K. Adhya attended the INSA Platinum Jubilee Meeting at Kolkata from 5 to 10 Dec 2009.

Dr D. Maiti attended the 5th International Conference on Plant Pathology at New Delhi during 9 to 12 Dec 2009. He gave an invited lecture "Integrated Approach of Exploiting Native Arbuscular Mycorrhizal Fungi for Improving Phosphorus Nutrition in Upland."

Dr D.P. Sinhababu attended the Workshop on "Credit Problems for Promoting Integrated Fish-horticulture System in Waterlogged Lowland Area in Orissa" organized by the National Bank for Agriculture and Rural Development at Bhubaneswar during 10 and 11 Dec 2009.

Drs V.D. Shukla, M. Variar, D. Maiti and S. Lenka attended the National Conference on "Pest Diversity in Rice and their Management under Changed Climate" organized by the AZRA from 15 to 16 Dec 2009 at CRRI, Cuttack.

Drs T.K. Adhya, Amal Ghosh, P. Samal and O.N. Singh from the CRRI, Cuttack participated in the fourth Annual Workshop of the ADB-supported Project "Development and Dissemination of Water-saving Rice Technologies in South Asia," in Kathmandu, Nepal from 16 to 17 Dec 2009. Dr T.K. Adhya Chaired Session 2 "Scientific Achievements and Impacts I." The workshop reviewed the progress in the project. The participants were from Bangladesh, India, Nepal, Pa-

kistan, IRRI, the Philippines,, and representatives from the Asian Development Bank.

Dr P. Samal attended the 69th Annual Conference of the Indian Society of Agricultural Economics at the Guru Nanak Dev University, Amritsar on 19 Dec 2009.

Dr T.K. Adhya attended the Annual Meeting of the Orissa Botanical Association at Banki College, Banki on 26 Dec 2009 and delivered the keynote address "Darwin and Microbial Evolution."

Dr T.K. Adhya attended the 97th Indian Science Congress at Thiruvananthapuram from 3 to 5 Jan 2010.

Drs G.J.N. Rao and S.R. Dhua attended the Awareness Meet on "Maintenance Breeding" held at Sardarkrishinagar Dantiwada Agricultural University, Sardarkrishinagar, Gujarat from 5 to 6 Jan 2010.

Dr S.M. Prasad attended the State Level Workshop for Programme Coordinators on "Strengthening Gender Prospective in Agricultural Research and Extension" at the DRWA, Bhubaneswar on 8 Jan 2010.

Dr T.K. Adhya attended the Half-yearly Review Meeting of the AMAAS at NBAIM, Mau on 9 Jan 2010.

Dr Sanjoy Saha attended the Half-yearly review meeting of the programme at BCKV, Kalyani from 12 to 13 Jan 2010.

Dr T.K. Adhya attended the meeting of the Division of Crop Sciences at ICAR, New Delhi on 17 and 18 Jan 2010.

Dr S.M. Prasad attended the State-level Workshop-cum-training programme of Master Trainer under NFSM at IMAGE, Bhubaneswar on 25 Jan 2010.

Dr K.S. Rao attended the 27th IMC meeting of CRIJAF, Barrackpore on 28 Jan 2010.

Dr S.M. Prasad attended a one day Workshop cum-training programme on "Control of Coconut Leaf Beetle in Coastal Area" organized at OUAT, Bhubaneswar on 28 Jan 2010.

Drs P. Mishra, M. Din, Shri B.C. Parida and Shri A.K. Choudhury attended the 44th ISAE convention at IARI, New Delhi from 28 to 30 Jan 2010.

Dr T.K. Adhya attended the selection committee meeting at ASRB, New Delhi on 30 Jan 2010.

Dr M. Variar attended the State Level Workshop of Master Trainers on Comprehension of Concepts under NFSM at SAMETI, Ranchi on 3 Feb 2010.

Dr P. Kaushal visited the NIPGR, New Delhi for project discussion on the DBT sponsored Apomixis Network Project from 9 to 14 Feb 2010.

Dr G.J.N. Rao attended the Director's conference at New Delhi from 15 to 17 Feb 2010.

Dr S.R. Dhua attended the ICAR Zonal Technology Management and Business Planning and Development Meeting-cum-Workshop for East Zone at IINRG, Ranchi from 19 to 20 Feb 2010.

Drs P. Mishra, M. Din and A.K. Choudhury attended the 16th Biennial Workshop of AICRP on Renewable Sources of Energy for Agriculture and Agro-based Industry. They presented the progress reports on Solar and Biogas Technology at CIAE, Bhopal from 18 to 21 Feb 2010.

Dr S.G. Sharma delivered a talk at the International Conference on "Role of Biomolecules in Food Security and Health Improvement" during XI Silver Jubilee Convention of the Indian Society of Agricultural Biochemists at BHU, Varanasi from 17 to 20 Feb 2010.

Dr V.D. Shukla attended the Regional Kisan Mela at the "Indian Institute of Natural Resins and Gums," Ranchi on 23 Feb 2010.

Dr R.K. Singh attended the CAC meeting of NAIP (C-3; Developing Sustainable Farming System Models for Prioritized Micro Watershed Rainfed Areas of Jharkhand) at Jamtara on 2 Mar 2010.

Dr T.K. Adhya attended the Brainstorming Session-cum-Launching Workshop of the Integrated Farming Systems Programme at the Kerala Agricultural University, Karmana from 6 to 7 Mar 2010.

Drs K.S. Rao, Arvind Shukla and R. Raja attended the workshop on "Use of Fly Ash in Agriculture" organized by the Centre for Fly Ash Research and Management at IHB, New Delhi on 9 Mar 2010.

Dr R.K. Singh attended the CAC meeting of NAIP (C-3; Developing Sustainable Farming System Models for Prioritized Micro Watershed Rainfed Areas of Jharkhand) at BAU, Ranchi on 10 Mar 2010.

Drs T.K. Adhya, J.N. Reddy, Sanjoy Saha, R.K. Sarkar, D.P. Singh, K.R. Mahata, Bijoya Bhattacharjee, Shri S.S.C. Patnaik and Shri B.C. Marndi attended the

meeting on "Submergence and Salinity Outputs and Breeding Networks Meetings" and the Third Annual Meeting of BMZ-funded project PVS Workshop" under STRASA at CISH, Lucknow from 9 to 11 Mar 2010. Presentations were made on the progress of research in Submergence Tolerant Varieties and Salt Tolerant Varieties that was followed by discussions on Eastern India Rainfed Lowland Shuttle Breeding Network (EIRLSBN) and Salinity Breeding Network (SBN). Progress was reviewed in the PVS discussions. A plan of work for 2010 was finalized. Dr David Mackill, IRRI, the Philippines is the project leader of BMGF STRASA.

Dr J.R. Mishra attended a training on "Agri-entrepreneurship Development and Management" at ZPD, Zone VII, Jabalpur from 10 to 12 Mar 2010.

Drs O.N. Singh, M. Variar, Padmini Swain and V.D. Shukla attended the Annual Planning Meeting of "Drought Breeding Network Meetings" and the "Upland Rice Shuttle Breeding Network" at BAU, Ranchi from 12 to 13 Mar 2010. The meeting comprised of a review of the progress in the Drought Breeding Network with presentations by the participating institutions, namely, CRURRS, Hazaribag, NDUAT, Faizabad, IGKVV, Raipur, TNAU, Coimbatore, BAU, Ranchi, Barwale Foundation, Hyderabad, DRR, ICAR, Hyderabad, University of Agricultural Sciences, Bangalore, Bangladesh Rice Research Institute (BRRI), Gazipur, Bangladesh, Rajsahi Rice Research Station, Bangladesh, National Rice Research Program (NRRP), Hardinath, Nepal and the Regional Agricultural Research Station, Nepalganj, Nepal. This was followed by the review of the Upland Rice Shuttle Breeding Network (URSBN) comprising of presentations of progress reports from three sub-programmes namely, Drought Breeding Network (DBN) with partners from India, Bangladesh and Nepal, Upland Rice Shuttle Breeding Network (URSBN) with partners from different ICAR Institutes and State Agricultural Universities (SAUs) of India, and the Consortium for Unfavourable Rice Environments (CURE).

Drs M. Variar, D. Maiti and N.P. Mandal attended the 4th CAC meeting of the NAIP (Allele mining and expression profiling of res.- and avirulence-genes in rice blast pathosystem for development of race non-specific disease resistance) at NRCPB, New Delhi on 16 Mar 2010.

Dr T.K. Adhya attended the ICSU meeting at INSA, New Delhi on 26 Mar 2010.

Radio and TV Talk

Dr Jyoti Nayak delivered a talk in the Nari Mahal programme over the Doordarshan on "Importance of Fruit Juice and Preparation of different Squash from Seasonal Fruits" on 12 Apr 2009.

Dr T.K. Adhya was interviewed on "Impact of Climate Change on Food Security of India" at the All India Radio, Cuttack for the National Science Magazine Programme "Radio Scope" on 21 July 2009.

The following programmes were recorded on 18 Aug 2009 at the Doordarshan, Hazaribag for telecast: Scientific Cultivation of Rice and Improved Varieties and Scientific Cultivation of Pulses in *Kharif* Season: Shri Manish Kumar.

Agroforestry, Scientific Cultivation of Papaya: Shri Rupesh Ranjan.

The following programmes were recorded on 8 Sep 2009 at the All India Radio, Hazaribag for broadcast: Disease Management in Sugarcane: Dr Mahesh Pathak.

Artificial Insemination: Dr Sudhanshu Shekhar. Commercial Use of Tomato and Chilli: Smt Chanchila Kumari.

Nursery Management of Timber Plants: Shri Rupesh Ranjan.

Exhibitions

The CRRI participated in the "Farmers Exhibition" at Krishi Vigyan Kendra, Ranital, Bhadrak on 15 Sep 2009. The fair was inaugurated by His Excellency, the Governor of Orissa, Shri Murlidhar Chandrakant Bhandare. The CRRI exhibited various technologies.

The CRRI exhibited its technologies in the State Level Interactive Workshop on "Participatory Irrigation Management" at WALMI, Cuttack during 15-16 Oct 2009.

The KVK, Santhapur exhibited technologies at the IV National Conference on KVK's at TNAU, Coimbatore, Tamil Nadu during 6–8 Nov 2009.

Workshops, Symposia, Seminars, Farmers' Day Organized

DDGs Formulate Policy in Expert Group Meeting at CRRI

Drs S.K. Datta, Deputy Director-General (Crop Sciences), ICAR, New Delhi and M.M. Pandey, DDG (Agricultural Engineering), ICAR, New Delhi, formulated recommendations for improving the quality of rice produced by the farmers in Orissa to meet the minimum procurement quality standards at the Expert Group Meeting on Quality of Rice in Orissa held in CRRI, Cuttack on 9 Oct 2009. The Expert Group meeting was convened at the instance of the Hon'ble Union Minister of Agriculture. The participants comprised of Drs R.T. Patil, Director, CIPHET, ICAR, Ludhiana, T.K. Adhya, Director, CRRI, Cuttack, M.C. Diwakar, Director, DRD, Patna, M.M. Panda, Dean of Research, OUAT, Bhubaneswar, V.K. Mishra, Technical Officer, Government of India, New Delhi, Shri K.N. Mallick, Food Corporation of India, Bhubaneswar, Shri Sanjay Somani and Shri S.K. Mohapatra from the Orissa Millers' Association (AROMA), and representatives from the OUAT, Bhubaneswar and CRRI, Cuttack.

The Expert Group Meeting was held in two parts. The first comprised of a visit to a modern rice mill at Tangi by all the participants where Dr M.M. Pandey held discussions with the millers on the processing problems and fair average quality of procured paddy. Shri S.L. Agarwal of the rice mill spoke on the constraints. This was followed by a meeting by the Expert Group in the CRRI, Cuttack where specific recommendations were formulated to address technological and policy level interventions.

Principal Investigator's Meeting Held

Dr A.B. Mandal, Project Director, DSR, ICAR, Mau spoke on the need to provide high quality pure seeds to the farmers during his opening remarks at the Principal Investigator's Meet 2009–10 at CRRI in Cuttack on 15 Mar 2010. The meeting formulated a plan to ensure quality seeds and to tackle post-harvest pests and diseases. Also present were Dr T.K. Adhya, Director, CRRI and Principal Investigators' from DSR.

At the Expert Group Meeting on Quality of Rice in Orissa held in CRRI, Cuttack on 9 Oct 2009, various policy decisions were made.

B. Behera

B. Behera

Dr D.P. Ray gave away the award to a progressive farmer (left). Farmers visit the CRRI Oryza museum (right).

CRRI Foundation Day

Change in the climate is affecting the scheduled planting of rice and other crops during *kharif* and *rabi*. The scientists will need to reorient their research to tackle these challenges so that the farmer is able to grow a crop that is appropriate for the prevailing conditions" said Dr D.P. Ray, Vice-Chancellor, OUAT, Bhubaneswar during his address at the 63rd CRRI Foundation Day in Cuttack on 2 May 2009. Dr T.K. Adhya, Director spoke on the progress in research at the CRRI. Drs A.E. Eknath, Director, CIFA, Bhubaneswar and Krishna Srinath, Director, DRWA, Bhubaneswar and farmers participated. Dr D.P. Ray felicitated the progressive farmers. He also gave the CRRI longest-serving Worker Award in different categories to personnel from the CRRI. Dr D.P. Ray also released four *CRRI Technology Bulletins*. In the evening Dr T.K. Adhya gave the CRRI Best Worker Award to personnel from different categories that were followed by a cultural programme.

B. Behera

Dr E.A. Siddiq hands over the certificate to Smt Tarangini Pradhan for adopting CRRI technologies.

Dhan Diwas Celebrated

Eastern India has a key role in the National Food Security as nearly 80% of rice is grown in this region. However, the eastern region also has serious problems of erratic rainfall, yield gap and migration that need to be resolved," said Dr E.A. Siddiq, Former DDG (Crop Sciences), ICAR, New Delhi, and currently Visiting Professor, ARI, ANGRAU, Hyderabad after inaugurating the Dhan Diwas at the CRRI, Cuttack on

26 Oct 2009. Dr T.K. Adhya, Director explained the objectives of the Dhan Diwas and asked the farmers to adopt technologies of the CRRI. Ten progressive farmers from Orissa were felicitated for their contribution to rice production and for the adoption of CRRI technologies.

World Food Day

The World Food Day was celebrated on 16 Oct 2009 at village Bainchua in Mahanga block. More than 200 farmers, farm women and rural youth participated.

NFSM Workshop Conducted

"Recent Advancements in Rice Research" was the Workshop sponsored by the National Food Security Mission, Orissa, and organized by the Directorate of Agriculture and Food Production, Orissa and the Institute on Management of Agricultural Extension (IMAGE), Bhubaneswar at the CRRI, Cuttack during 4–5 May 2009. Dr T.K. Adhya, Director, CRRI, chaired the Workshop. The delegates were Dr U.S. Singh, South-Asia Co-ordinator, IRRI, New Delhi, Shri A.K. Padhee, IAS, Director of Agriculture and Food Production, Government of Orissa, Shri B.C. Giri, Joint Director of Agriculture (SP&C), Government of Orissa, and District Agriculture Officers and scientists from the CRRI, Cuttack.

Hindi Fortnight

Hindi language signifies our nationality as well as Indian identity," said Smt Pushpa Singhi, Littérateur during her address at the concluding ceremony of the Hindi Fortnight 2009 on 6 Oct 2009 at the CRRI, Cuttack. A Hindi Kavi Sammelan was also organized. Shri J.P. Gupta, Former Honorary Professor (English), Bhadrak College, Bhadrak, Smt Anita Bhavsinghka, Co-Editor, *Prerana,* Cuttack and Shri T.P. Tripathi, Lecturer, IPSAR College, Cuttack participated as poets. During the Hindi Fortnight held from 14 to 28 Sep 2009, five Hindi Competitions were organized for the staff whose mother tongue is other than Hindi. Cash awards were awarded for each competition. Dr T.K. Adhya, Director, CRRI presided over the meeting.


B. Behera

Smt Anita Bhavsinghka recited poems during the concluding ceremony of the Hindi Fortnight.

Vigilance Awareness Week

At the concluding ceremony of the Vigilance Awareness Week on 7 Nov 2009, Shri A.K. Patnaik, IPS, Director-cum Director-General and IG Police (Vigi-

Shri A.K. Patnaik, IPS spoke on preventive vigilance.


B. Behera

lance), Cuttack, spoke on "Corruption and the Rules and Regulations Enforced by the Vigilance Department for keeping the Organization free from Corruption and different means of Curbing it." He said that preventive vigilance was always better than detective vigilance. The CRRI observed the Vigilance Awareness Week from 3 to 7 Nov 2009. Dr T.K. Adhya, Director administered the pledge to the staff followed by reading of the message from the Central Vigilance Commission, Government of India by Shri S.K. Sinha, SAO-cum-Vigilance Officer, CRRI. An essay competition on "Self-inspiration is the Key for Disciplined and Corruption Free Society," in English, Hindi and Oriya was conducted.

Kisan Melas/Kisan Gosthi

The CRURRS, Hazaribag held a farmers' fair in village Singrawan on 1 Oct 2009 with the objective of familiarizing the farmers to the newly introduced short duration, drought-tolerant rice varieties.

The KVK, Koderma conducted Kisan Melas in Block Markacho on 21 Jan 2010, Block Koderma on 22 Jan 2010, Block Chandwara on 25 Jan 2010, Block Domchach on 27 Jan 2010, Block Jainagar on 28 Jan 2010 and Block Sadgaon on 29 Jan 2010.

Two District level Kisan Melas were held in Koderma on 8 and 9 Mar 2010.

The KVK, Santhapur organized a Kisan Gosthi in village Chasa Barbati of Narasinghpur block on 25 Feb 2010. More than 100 farmers participated.

Dr K.D. Kokate, spoke on the vital and important role played by farm women in farming.

KVK, Santhapur

Women in Agriculture Day: Farm women play a vital and important role in farming," said Dr K.D. Kokate, DDG (Agricultural Extension), ICAR, New Delhi after inaugurating the "Women in Agriculture Day" at the KVK, Santhapur on 4 Dec 2009. He outlined the new initiatives taken-up by the ICAR for spreading the technologies developed by ICAR through its KVKs. Dr S.S. Nanda, Dean (Extension), OUAT, Bhubaneswar and Dr T.K. Adhya, Director, CRRI also participated.

Krusak Sampark Mela: The KVK, Santhapur participated in the Krusak Sampark Mela organized by ATMA at Uchapada of Tangi Block on 2 Feb 2010 and in Kujiranga of Mahanga Block on 18 Feb 2010.

NAIP Activities

NAIP, Component-4 (2031)

CIC Meeting: Dr T.K. Adhya chaired the Consortium Implementation Committee (CIC) meeting of the National Agriculture Innovation Project (NAIP), Component-4 (2031) "Soil Organic Carbon Dynamics vis-a-vis Anticipatory Climatic Changes and Crop Adaptation Strategies" at CRRI, Cuttack on 20 Jun 2009. The meeting was attended by Drs P. Bhattacharyya, Consortium Principal Investigator, K.S. Rao, Co-PI and Head, Division of Crop Production, CRRI, M.C. Manna, Head, Soil Biology, IISS, ICAR, Bhopal, S.S. Pal, Principal Scientist, PDCSR, Meerut, R.K. Bajpai, Associate Professor, IGKVV, Raipur, K. Chendrayan, Professor, Tamilnadu Agricultural University, D.R.D. Srinivas, Senior Scientist, APRRI and RARS, Maruteru, A. Pandit, Member, CRRI, Cuttack, Shri S.K. Sinha, SAO, CRRI, and Shri P.C. Naik, FAO (I/c), CRRI. The meeting reviewed the status of implementation of the project in the respective centres. After detailed discussion on methodologies a programme of work for implementation was prepared.

Review Meeting: The third CIC, second CAC and Mid-term Review Workshop was held at CRRI, Cuttack from 30 Jul to 1 Aug 2009. Dr Anand Swarup, Head, Division of Soil Science and Agricultural Chemistry, IARI, ICAR, New Delhi was the Chief Guest. The participants were Drs A. Bandyopadhyay, National Coordinator, NAIP, Component-4, D.C. Uprety, Chair-

man, CAC and ICAR Emeritus Scientist, Division of Plant Physiology, IARI, New Delhi, S.N. Singh, Scientist-G, Deputy Director and Head, Division of Environmental Sciences, NBRI, Lucknow, V.R. Rao, T.K. Adhya, P. Bhattacharyya, M.C. Manna, S.S. Pal, K. Chendrayan, R.K. Bajpai, and D. Srinivas.

Training Workshop: Seventeen trainees were trained in the 21-days Training Workshop on "Greenhouse Gas Emission and its Mitigation in Relation to Soil Organic Carbon (SOC) Pool" at CRRI, Cuttack from 5 to 25 Jan 2010. The trainees were from the IISS, Bhopal, NRC for Orchids, Sikkim, IGKVV, Raipur, IARI, New Delhi, Department of Agriculture, Government of West Bengal, Kolkata, University of Kalyani, Kalyani, West Bengal, Assam University, Assam, Directorate of Irrigation Research and Development, Pune, Maharashtra, Anand Agricultural University, Anand, Gujarat and CRRI, Cuttack. The invited lectures were delivered by Dr Biswapati Mandal, Professor, BCKV, West Bengal, Dr D.C. Uprety, ICAR Emeritus Scientist, IARI, New Delhi, Dr S. Pasupalak, Professor, OUAT, Bhubaneswar, Dr M.C. Manna, Principal Scientist, IISS, Bhopal, Dr S.S. Pal, Principal Scientist, PDFSR, Modipuram, Meerut, Dr R.K. Bajpai, Professor, IGAU, Raipur, Dr K. Chendrayan, Professor, TNAU, Coimbatore and Dr D. Srinivas, Senior Scientist, APRRI and RARS, Maruteru.

CAC Meeting: The CAC Meeting was held at CRRI, Cuttack on 18 Mar 2010. Dr D.C. Uprety, Chairman, CAC, Dr S.N. Singh, Head, Environmental Science, NBRI, Lucknow and Dr V.R. Rao were present in the meeting.

Training on User Awareness Programme

Consortium for e-Resources in Agriculture" is the NAIP programme for accessing e-journals from different publishers worldwide. Shri Vivekananda Mehendale, Training Executive, Informatics (India) Limited, Bangalore imparted a training on accessing these journals at the CRRI, Cuttack on 12 Mar 2010. The Consortium PI and Head is based at the Unit of Simulation and Informatics, IARI, ICAR, New Delhi. The CRRI is part of this Consortium.

National Media Meet

The CRRI, Cuttack organized a National Media Meet on 24 Aug 2009 under the NAIP Sub Project "Mobilizing Mass Media Support for Sharing Agro Information." The delegates comprised of participants from the print and broadcast media. Drs T.K. Adhya, Director, CRRI, T.P. Trivedi, Project Director (DIPA) and ADG (ARIS), B.N. Chattopadhyay, Coordinator and Nodal Officer, Media and Information, Jagdeep Saxena, Editor and Shri Anil Kumar Sharma, addressed the media.

NAIP Training Programme on Procurement

A Training programme for consortia partners under NAIP on "Procurement Related Matters and Financial Management" was held at CRRI, Cuttack from 17 to 18 Sep 2009 for scientists and staff associated with NAIP Projects from the CRRI, OUAT, CIFA, WTCER and NGO. Shri S.R. Khuntia, SFAO, NAIP, New Delhi along with three consultants from RITES and Ernst and Young imparted the training. Dr T.K. Adhya, Director, CRRI inaugurated the training programme. Shri S.K. Sinha, SAO, CRRI was the local Co-ordinator.

NAIP Component-1 Project RKMP

The inaugural Workshop of NAIP Component-1 funded project on "Development and Maintenance of Rice Knowledge Management Portal (RKMP)" was held at CRRI, Cuttack on 19 Sep 2009. Dr N.T. Yaduraju, National Co-ordinator, NAIP was the Chief Guest. Dr T.K. Adhya presided over the function. Drs B.C. Viraktamath, Consortium Leader, S.N. Meera, Consortium PI and Dr G.A.K. Kumar, Consortium Co-PI participated in the meeting and spoke on the objectives of the project.

The Content Development Workshop was held at CRRI, Cuttack on 16 Mar 2010. Dr T.K. Adhya, Director, CRRI presided over the function. Drs S.N. Meera

and G.A.K. Kumar spoke about RKMP and requirement of information for Research Information System (RIS), Extension Information System (EIS), Service Information System (SIS), Farming Information System (FIS) and General Information System (GnIS). Participants were from the CRRI, ICAR, Cuttack, DRR, ICAR, Hyderabad, National Agricultural Co-operative Marketing Federation of India Ltd., Bhubaneswar, FCI in Cuttack and Bhubaneswar, Orissa State Seeds Corporation Ltd., Bhubaneswar and the Orissa State Civil Supplies Corporation Ltd., Bhubaneswar.

NAIP Component-2
CAC and CMU Meetings Held

The CAC and CMU meeting of the NAIP, Component-2, on "Capitalization of Prominent Landraces of Rice in Orissa through Value Chain Approach" was conducted by the lead institution M.S. Swaminathan Research Foundation (MSSRF), Jeypore at the CRRI, Cuttack on 14 Oct 2009. Dr S.D. Sharma, Chairman, CAC, gave the keynote address. Dr T.K. Adhya, Director, CRRI gave the welcome address. Shri S.V. Ramana, Chairman, CMU, scientists and officers from MSSRF, Consortium partners from CRRI, Cuttack, KVK, OUAT, Semiliguda, Koraput and the Orissa Rural Marketing and Development Society (ORMAS), Koraput attended the meeting.

Winter School

The CRRI organized the ICAR sponsored Winter School on "Entrepreneurship Development and Agribusiness Management" at CRRI, Cuttack from 3 to 23 Dec 2009. The participants were from the UAS, Bangalore, AICRP on IFS, KVKs in Angul, Jharsuguda, Sikkim Centre of the ICAR Research Complex, Kandhamal and Puri. The objective of the course was to refresh the knowledge and skill of participants in entrepreneurship development and agribusiness management.

Training Programmes

A farmer training-cum-interaction meeting on water saving technologies in irrigated rice was organized in Kochila Nuagaon village of Chowdwar block, Cuttack district on 29 Apr 2009. More than 100 farmers participated. This activity was funded by the ADB-IRRI-ICAR collaborative project "Development and Dissemination of Water-saving Rice Technologies in South Asia." The project also held a training programme on water-saving technologies at village Samian, Badchana block of Jajpur district on 29 May 2009 that was attended by 129 farmers.

A training programme on "Rice-fish Farming System" sponsored by State Agricultural Management Institute, Lucknow was held at CRRI, Cuttack from 29 Dec 2009 to 2 Jan 2010.

A Department of Science and Technology (DST), New Delhi sponsored training programme on "Technology-based Entrepreneurship Development Programme on Rice-fish Farming System" and implemented by the Entrepreneurship Development Institute of India, Ahmedabad was organized by CRRI, Cuttack from 6 Jan to 16 Feb 2010. Twentyone potential agri-entrepreneurs from Orissa were trained.

A training on technology based Entrepreneurship Development programme on "Rice-fish Farming System" sponsored by DST, New Delhi was held at CRRI, Cuttack 6 to 16 Feb 2010.

The Directorate of Extension, Ministry of Agriculture, Government of India, New Delhi sponsored training programme on "Rice Production Technology" was organized by the CRRI, Cuttack from 18 to 25 Feb 2010. Twenty Agricultural Officers from Andhra Pradesh, Jharkhand, Bihar, Chhattisgarh and Orissa were trained.

A training-cum-exposure programme on "Integrated Rice-based Farming System" under the Rashtriya Krishi Vikash Yojana (RKVY), sponsored by the District Agriculture Office, Purnea, Bihar was organized by CRRI, Cuttack from 15 to 20 Mar 2010. There were 19 participants from Bihar.

Two training programmes were conducted at CRRI, Cuttack under the DST Project on "Bio-intensive Management of Rice Pests with Emphasis on Botanicals" during 10 to 11 Mar 2010, and 12 to 13 Mar 2010. In

the first training programme on "Bio-intensive methods of Pest Management in Rice," 70 farmers from Erasama Block in Jagatsinghpur district (Kiada and Kimilo villages), Pipili Block in Puri district and Nilgiri Block, Balasore district participated. The second training programme was conducted exclusively for 20 farmers of Nilgiri block, Balasore district on "Preparation and Application of Botanical Formulations against Rice Pests and Scope of Entrepreneurship Development."

A training programme on "Identification and Management Strategies for Quarantine and Invasive Weeds" was held at CRRI, Cuttack on 29 Mar 2010 under the "National Invasive Weed Surveillance (NIWS) Programme" for 25 participants from the CRRI KVK, Santhapur, OUATKVK, Kendrapara, OUATKVK, Jajpur and DDA from districts of Cuttack, Jagatsinghpur, Jajpur, Kendrapara, Bhadrak, Balasore, Mayurbhanj, Keonjhar, Sundergarh in Orissa. They were trained on early detection of *Cenchrus tribuloides*, *Solanum carolinense, Viola arvensis, Cynoglossum officinale* and *Ambrosia trifida.*

STRASA Training Course : Experimental Design and Data Analysis CROPSTAT for Plant Breeders" was the training course sponsored under the project "STRASA," IRRI, Philippines at the CRRI, Cuttack from 7 to 11 Sep 2009. Dr K. Anitha Raman, Biometrician, IRRI, Philippines and Ms Violeta Bartolome, Senior Associate Scientist-Biometrics IRRI, Philippines imparted the training in CROPSTAT software to 27 participants from India including two from Nepal.

Gopinath Sahu Memorial Lecture

Growing Rice in a Changing Climate" was the topic of the 18th Gopinath Sahu Memorial Lecture delivered by Dr T.K. Adhya, Director, CRRI under the Chairmanship of Dr N. Sahoo, Vice-President, ARRW on 3 Nov 2009 at the CRRI, Cuttack. Dr K.S. Rao, Secretary, ARRW welcomed the speaker. Prof B. Jena, President, Dr Gopinath Sahu Memorial Trust spoke on the activities of the trust and on the Annual Lecture.

Technology Week Celebrated

Shri C.S. Behera, Hon'ble MLA, Tangi-Salipur inaugurated the Technology Week from 18 to 23 Jan 2010 at the KVK, Santhapur. He asked the farmers to adopt the technologies available at the KVK. More than 1,000 farmers, farmwomen and rural youth of different KVK adopted villages participated. The farmers' were trained on "Farm Equipments and Implements," "Agricultural Inputs," "Pheromone Traps," "Biofertilizers," "Poultry Keeping," "Animal Husbandry," and "Crop Production Technologies."

Institute Seminar

Dr C.D. Mishra on "Current Status of Major Rice Nematodes and their Management" on 3 Apr 2009.

Shri B.C. Marandi on "Conservation and Evaluation of Genetic Resources in Rice" on 17 Apr 2009.

Dr Bijoya Bhattarcharjee on "Recent Advances in Engineering the Salt-tolerance Crop Plants" on 27 Apr 2009.

Dr B.B. Panda on "Crop Growth Simulation for Optimization of Management Decision" on 8 May 2009.

Dr L. Bose on "Problems and Prospects of Wide Hybridization" on 15 May 2009.

Dr P.C. Mohapatra on "Multi-crop System in Rainfed Areas through Rainwater Management" on 22 May 2009.

Dr S.C. Sahu on "Fine Mapping of the Gall Midge Resistant Gene Gm 4" on 5 Jun 2009.

Dr S.S.C. Pattnaik on "Breeding for Shallow Lowlands" on 12 Jun 2009.

Dr S.G. Sharma on "Speciality Rice Research at CRRI" on 19 Jun 2009.

Dr Gouri Padhi on "Stem Borer in Rice and their Management" on 3 Jul 2009.

Dr K.K. Jena, IRRI on "A New Gene *p-40* for Broadspectrum Durable Blast Resistance and MA Selection in Rice Improvement" on 10 Jul 2009.

Dr A. Ghosh on "Organic Agriculture" on 10 Jul 2009.

Dr T.K. Dangar on "Microbial Control of Rice Pests" on 24 Jul 2009.

Dr D.P. Singh on "Problems and Prospects of Coastal Saline Ecosystem in India" on 1 Aug 2009.

Dr Padmini Swain on "Screen for Drought-tolerance—Priorities and Prospects" on 7 Aug 2009.

Dr R.N. Rao on "Development of Hybrid Rice for Shallow Lowlands" on 14 Aug 2009.

Dr P. Mishra on "Postharvest Technology and Value addition in Rice" on 21 Aug 2009.

Dr Urmila Dhua on "Integrated Scoring System for Rice Blast" on 28 Aug 2009.

Dr Jagadiswari Rao on "Mite in Rice Ecosystems" on 4 Sep 2009.

Shri S.P. Patel on "Changing Scenario of Power and Energy-use and Energy Consumption Pattern" on 11 Sep 2009.

Dr M. Din on "Status of Farm Mechanization for Rice and Horticultural Crops in Andaman and Nicobar Islands" on 22 Sep 2009.

Shri A.K. Patnaik on "Breeding Short-grain Aromatic Rices" on 25 Sep 2009.

Dr Bijoy Singh, Panjab Agricultural University (PAU), Ludhiana on "Green seeker™ Optical sensor for Nitrogen Management in Crops" on 6 Oct 2009.

Dr D. Swain on "Gene Flow from Cultivated to Weedy and Wild Rice and its Environmental Consequences" on 12 Oct 2009.

Dr Sanjukta Das on "Grain Quality Research Issues and Future Prospects" on 16 Oct 2009.

Dr K.S. Rao on "Water-saving Technologies in Irrigated Rice" on 23 Oct 2009.

Dr Arvind Kumar, Scientist (Drought and Aerobic Rice), IRRI, Philippines on "Making Rice less Thirsty to Tackle Drought—Strategies and Progress" on 29 Oct 2009.

Dr Meera Kar on "Breeding for Resistance to RTD" on 30 Oct 2009.

Dr Annie Poonam on "Precision Agriculture Concept and Application" on 6 Nov 2009.

Dr Abhijit Das on "Iron Metabolism in Plants" on 13 Nov 2009.

Dr G.J.N. Rao on "Double Haploid Breeding in Rice" on 20 Nov 2009.

Dr K.R. Mahata on "Tillage and Soil Structure Management for Rice-based Cropping System" on 27 Nov 2009.

Dr P. Kaushal on "Gene Regulations in Apomixes" on 27 Nov 2009.

Dr J.N. Reddy on "Varietal Improvement for Submergence-prone and Medium-deep Waterlogged Lowland Areas of Eastern India—Problem and Prospects" on 5 Dec 2009.

Dr K.M. Das on "Management of Bacterial Blight of Rice" on 14 Dec 2009.

Dr L. Behera on "Rice Genomics: Progress and Prospects" on 18 Dec 2009.

Dr S.K. Dash on "Breaking Yield barrier of Rice: New Plant Type Approach" on 1 Jan 2010.

Kum Mamata Jena on "Quantitative Trait Loci Associated with Root-knot Nematode in Rice" on 8 Jan 2010.

Dr K.L. Pandey on "Adaptation of Rice Cultivars to Farm Mechanization in Surinam" on 15 Jan 2010.

Shri B.C. Parida on "Ergonomics: Safety and Efficiency of Agricultural Implements" on 22 Jan 2010.

Dr P. Samal on "Impact of GATT on Rice Export from India and the On-going Negotiations" on 29 Jan 2010.

Dr A. Pandit on "Contract Farming—Pros and Cons" on 6 Feb 2010.

Dr P.K. Nayak on "Integrated Farming System" on 12 Feb 2010.

Dr H.N. Subudhi on "Bio-diversity of Specialty Rice and Future Prospects" on 19 Feb 2010.

Shri J. Meher on "Progress in Enhancing Yield Potential in Rice" on 3 Mar 2010.

Dr R.K. Sarkar on "Plant Phenomics in Improving Solar Energy Efficiency and Biomass Production of Rice Adapted to Climate Change" on 4 Mar 2010.

Dr S.K. Pradhan on "Marker-assisted Introgression in Rice Breeding Programme" on 5 Mar 2010.

Dr R.K. Sahu on "Breeding for Resistance to BPH in Rice" on 12 Mar 2010.

Distinguished Visitors

P. Kar

Dr S.K. Datta has a look at a rice line in the experimental field in CRRI, Cuttack.

Dr T.K. Adhya (centre) explains the OTC facility to Dr M.J. Modayil (right).

Cuttack

Dr D.P. Ray, Vice Chancellor, OUAT, on 2 May 2009.

Drs S.K. Datta, Deputy Director-General (Crop Sciences), ICAR, New Delhi and M.M. Pandey, DDG (Agricultural Engineering), ICAR, New Delhi, on 9 Oct 2009.

Dr E.A. Siddiq, Former Deputy Director-General (Crop Sciences), ICAR, New Delhi on 26 Oct 2009.

Drs Dath K. Mita, Crop Analyst, International Production Assessment Division, Office of Global Analysis, USDA Foreign Agricultural Service, Washington, DC and Dr A. Govindan, Senior Agricultural Specialist, FAS / USDA, American Embassy New Delhi, on 30 Oct 2009.

Shri A.K. Pattnaik, IPS, Director-cum-Director-General and IGPolice (Vigilance), Cuttack on 3 Nov 2009.

Dr R.S. Zeigler, Director-General, IRRI, Philippines on 19 Nov 2009. He was accompanied by Dr S. Mohanty, Head, Social Science, IRRI, Philippines.

Dr M.J. Modayil, Member, Agricultural Scientists' Recruitment Board, New Delhi, on 11 Dec 2009.

Dr D. Rout, Hon'ble Minister of Agriculture, Cooperation, Fisheries and Animal Resources Development, Government of Orissa on 1 Feb 2010.

Dr R.S. Zeigler has a look at the rice lines in the Salinity Screening Facility at the CRRI, Cuttack.

P. Kar

Dr D. Rout, spoke on the role of sports during his address at the TEZ 2010 at CRRI, Cuttack.

B. Behera

KVK, Santhapur

Dr K.D. Kokate visited the FLDs in the KVK-adopted village Uchapada.

Shri C.S. Behera, lights the lamp to inaugurate the Technology Week at the KVK, Santhapur.

Shri M.S. Padhi, IAS, Commissioner-cum-Secretary, Department of Higher Education, Government of Orissa, on 5 Feb 2010.

Hazaribag

Dr S.P. Tewari, DDG (Agricultural Education), ICAR, New Delhi, on 28 Oct 2009.

KVK, Santhapur

Dr K.D. Kokate, Deputy Director-General (Agricultural Extension), ICAR, New Delhi on 4 Dec 2009.

Shri C.S. Behera, Hon'ble MLA, Tangi-Salipur on 18 Jan 2010.

Ravi Viswanathan

Awards/Recognition

The CRRI Awarded the Sardar Patel Outstanding ICAR Institution Award 2008 for Outstanding Contribution in the Field of "Agricultural Research and Extension"

Dr T.K. Adhya, Director, CRRI received the award on 16 July 2009 from Dr Farooq Abdullah, Hon'ble Union Minister of New and Renewable Energy, Government of India. The CRRI was given the Award in recognition of its outstanding contribution in improving the income and quality of life of rice farmers in India. The award consists of a citation, a shield and a cash prize.

Prof. G. Rangasami Award 2009 in Agricultural Microbiology

Dr T.K. Adhya, Director, CRRI, Cuttack was awarded the Prof. G. Rangasami Award 2009 in Agricultural Microbiology of the Association of Microbiologists of India (AMI). The award was conferred on Dr Adhya for his work on agricultural microbiology with environmental impact.

Fellowship in Societies/Member in Committees

Dr T.K. Adhya was elected as a Fellow of the West Bengal Academy of Science and Technology, Kolkata. He was admitted to the Academy during the Annual General Body Meeting of the Academy held at the Central Glass and Ceramic Research Institute, Jadavpur, Kolkata, on 30 Dec 2009.

Dr T.K. Adhya, Director, CRRI was elected as the President of the Section of Agriculture and Forestry Sciences for 2010–11, the 98th Session of the Indian Science Congress. The 98th session of the Indian Science Congress will be held at the SRM University, Chennai in Jan 2011.

Sports

TEZ 2010 held at CRRI

Dr Damodar Rout, Hon'ble Minister of Agriculture, Co-operation, Fisheries and Animal Resources Development, Government of Orissa, inaugurated the Tournament of Eastern Zone (TEZ 2010) at CRRI, Cuttack on 1 Feb 2010. The participants included 450 men and women from the ICAR Research Complex for Eastern Region, Patna, ICAR Research Complex for NEH Region, Meghalaya, IINRG, Ranchi, DWMR, Bhubaneswar, NRC on Mithun, Nagaland, NRC of Yak, Dirang, CRRI, Cuttack, CIFA, Bhubaneswar, NRC for Orchids, Tandog, DRWA, Bhubaneswar, ZPD, Zone-II, Kolkata, CRIJAF, Barrackpore, NIRJAFT, Kolkata, IVRI, Izatnagar, NRC for Pig, Guwahati, NRC Litchi, Muzaffarpur, PDFMD, IVRI Campus, Mukteswar and CIFRI, Barrackpore. They competed in 34 events spread over 1 to 5 Feb 2010. The CRRI, Cuttack was awarded the Overall Championship Trophy. The Overall Runners-up Trophy was given to the IVRI, Izatnagar.

The CRRI sports team secured the second position in the ICAR Inter-Zonal Final meet at NDRI, Karnal

B. Behera

A view of the participating teams at TEZ 2010.

Shri P.K. Parida (left), receives the Best Athlete award from Shri M.S. Padhi (right).

from 12 to 15 Dec 2009. The Kabaddi team defended its Championship title successfully and made it three-in-a-row. The CRRI won the first position in the 4 x 100 m relay race, 100 m, 200 m and 400 m race and the second position in 800 m and 1,500 m race for men. Shri P.K. Parida was adjudged the best athlete of the Tournament, the second time in succession.

CRRI in Kabaddi

The CRRI kabaddi team won the 57th Senior Orissa State Kabaddi Championship 2009, defeating the Orissa Police kabaddi team during 28 to 31 May 2009 at Bhubaneswar. The Championship was organized by the Bhubaneswar Athletic Association and was hosted by the Young Sporting Club, Bhubaneswar. The awards of Best Catcher, Best Raider in the semifinals and finals, and the Man of the Tournament were bagged by CRRI. The CRRI kabaddi team won the Championship consecutively for the second year.

Shri P.K. Parida and Shri B.K. Sahoo, CRRI, Cuttack represented the Orissa Kabaddi Team as Player and Manager, respectively in the 57th Senior Zonal National Kabaddi Championship held in Cuttack from 15 to 17 Jan 2010.

Shri P.K. Parida represented the Orissa State Kabaddi Team in the 57th Senior National Kabaddi Championship at Dombivali in Maharashtra from 17 to 21 Feb 2010.

The kabaddi team gets together for a group photograph with their trophy and individual medals.

Courtesty: NDRI, Karnal

Shri P.K. Parida (centre at 1) was adjudged the best athlete of the Tournament.

Deepti Sahoo

Personnel

Staff Strength as on 31 March 2010

	Posts at CRRI, Cuttack			Posts at KVK, Santhapur			Posts at KVK, Koderma		
Category	Sanctioned	Filled	Vacant	Sanctioned	Filled	Vacant	Sanctioned	Filled	Vacant
Scientist	115	82	33	4	2	2	1	1	-
Technical	180	133	47	11	3	8	11	9	2
Administrative	104	89	15	2	1	1	2	1	1
Supporting	165	98	67	2	2	-	2	2	-
Canteen	5	5	-	-	-	-	-	-	-
Sub-total	569	407	162	19	8	11	16	13	3
RMP	1	1	-	-	-	-	-	-	-
Total	570	408	162	19	8	11	16	13	3

T.K.Adhya ..... Director

Crop Improvement

G.J.N.Rao ..... Principal Scientist and Head
Plant Breeding
S.R.Dhua ..... Principal Scientist
O.N.Singh ..... Principal Scientist
K. Pande ..... Principal Scientist
J.N.Reddy ..... Principal Scientist
Ashok Pattnaik ..... Principal Scientist
Meera Ku. Kar ..... Senior Scientist
S.K.Pradhan ..... Senior Scientist
Lotan K. Bose ..... Senior Scientist
K. Chattopadhyay ..... Senior Scientist
S.K. Dash ..... Senior Scientist (from 4 Jun 2009)
J. Meher ..... Scientist (SS)
Ramesh Chandra ..... Jr. Tech. Asstt.
..... on deputation from 19 Jan 2010
A.V.G. Sharma ..... Senior Mechanic

Genetics and Cytogenetics

R.N. Rao ..... Principal Scientist
R.K. Sahu ..... Scientist (S.G.)
S.S.C. Pattnaik ..... Scientist (S.G.)

Economic Botany

B.C. Patra ..... Principal Scientist
D. Swain ..... Senior Scientist
H.N. Subudhi ..... Senior Scientist
B.C. Marndi ..... Senior Scientist

Biotechnology

Pankaj Kaushal ..... Principal Scientist
Lambodar Behera ..... Senior Scientist
Bijoya Bhattacharjee ..... Senior Scientist
B.S. Subramanian ..... Scientist

Crop Production

K.S. Rao ..... Principal Scientist and Head

Agronomy

Amal Ghosh ..... Senior Scientist

Sanjoy Saha ..... Senior Scientist

Annie Poonam ..... Senior Scientist

R. Raja ..... Senior Scientist

B.B. Panda ..... Senior Scientist

Fish and Fisheries

D.P. Sinhababu ..... Principal Scientist

P.K .Nayak ..... Principal Scientist

Soil Science/Soil Chemistry/Fertility & Microbiology

A.K. Mishra. Principal Scientist (retired on 31 Aug 2009)

R.N. DashPrincipal Scientist (retired on 30 Sep 2009)

A.K. Shukla ..... Principal Scientist

P. Bhattacharyya ..... Senior Scientist

Sangita Mohanty ..... Scientist (from 28 Aug 2009)

Mohammad Shahid ..... Scientist (from 3 Nov 2009)

R.R. Dash .. Field Assistant (retired on 31 Oct 2009)

Kusha PandaSr. Scientific Assistant (retired on 28 Feb 2010)

Soil Science/Soil Physics/Soil Water Conservation

K.R. Mahato ..... Principal Scientist

Rahul Tripathi ..... Scientist (from 20 Jun 2009)

Microbiology

T.K. Dangar ..... Principal Scientist

B. Ramakrishnan ..... Senior Scientist

Agricultural Engineering

P.C. Mohapatra ..... Principal Scientist

P.N. Mishra ..... Principal Scientist

M. Din ..... Principal Scientist

B.C. Parida ..... Principal Scientist

S.P. Patel ..... Principal Scientist

A.K. Choudhury ..... Principal Scientist

Crop Protection

Anand Prakash ..... Principal Scientist and Head

Plant Pathology

Urmila Dhua ..... Principal Scientist

S.N. Tewari ..... Principal Scientist

G. Bhaktavastalam ..... Senior Scientist

K.M. Das ..... Senior Scientist

S.K. Singh ..... Scientist (Sr. Scale)

Entomology

Jagadiswari Rao ..... Principal Scientist

Gauri PadhiPrincipal Scientist (retired on 31 Jul 2009)

R.C. DaniPrincipal Scientist (retired on 31 Jul 2009)

S. Sasmal ..... Principal Scientist

K.S. Behera ..... Principal Scientist

Mayabini Jena ..... Principal Scientist

P.C. Rath ..... Senior Scientist

V. Nandagopal ..... Senior Scientist

Nematology

S.C. Sahu ..... Principal Scientist

C.D. Mishra ..... Senior Scientist

Biochemistry, Physiology and Environmental Sciences

S.G. Sharma ..... Principal Scientist and Head

Biochemistry

Avjit Das ..... Senior Scientist

Plant Physiology

D.P. Singh ..... Principal Scientist
R.K. Sarkar ..... Principal Scientist
Sanjukta Das ..... Principal Scientist
Padmini Swain ..... Principal Scientist
M.J. Baig ..... Senior Scientist
Neeta Dwivedi ..... Senior Scientist
..... (from 29 Apr 2009)

Biophysics

Pramila Krishnan ..... Senior Scientist

Social Science and Extension, Communication and Training

Agricultural Statistics

N.P. Jambhulkar ..... Scientist (from 15 Mar 2010)

Agricultural Economics

Parshuram Samal ..... Principal Scientist
Arun Pandit ..... Senior Scientist

Extension, Communication and Training

N.C. Rath ..... Senior Scientist
G.A.K. Kumar ..... Senior Scientist
Lipi Das ..... Scientist (SS)
Ravi Viswanathan..Editor-cum-Information Officer
P. Jana ..... Rice Production Training Assistant
P.K. Mohanty ..... Artist
Prakash Kar ..... Sr. Photographer

Automobile Unit

K.K.Swain ..... Mechanical Engineer

Farm Unit

D.S. MeenaTraining Assistant and I/c Farm Supdt.

Dispensary

P. Mohapatra ..... Medical Officer

CRURRS, Hazaribag

M. Variar ..... Principal Scientist and OIC
..... (from 19 Feb 2010)
P.K. Sinha ..... Principal Scientist and OIC
..... (Retired on 31Aug 2009)
R.K. Singh ..... Principal Scientist
N.P. Mandal ..... Senior Scientist
J. Terom ..... Senior Farm Assistant
C.V. Singh ..... Scientist (S.G.)
V.D. Shukla ..... Principal Scientist
D. Maiti ..... Principal Scientist

RRLRRS, Gerua, Assam

Narayan Bhakta ..... Scientist (Sr. Scale) and I/c
S.K. Raoutray ..... Senior Scientist (till 19 May 2009)
S. Lenka ..... Senior Scientist (from 8 Jun 2009)
N.C. Pande ..... Scientist (Sr. Scale)

KVK, Santhapur

S.M. Prasad ..... Senior Scientist
K. Vanitha ..... Scientist (from 28 Aug 2009)
J.R. Mishra ..... Sr. Trg. Asstt.
Jyoti Nayak ..... Sr. Trg. Asstt. (till 30 Jun 2009)
S. Lenka ... Sr. Training Assistant (till 30 May 2009)
P.K. Mallick ..... Sr. Training Assistant

KVK, Jainagar, Koderma

V.K. Singh ..... Senior Scientist (from 21 Dec 2009)
Dandapat ..... Sr. Training Assistant
Chanchila Kumari ..... Sr. Training Assistant
Sudhanshu Sekhar ..... Sr. Training Assistant
Mahesh Pathak ..... Sr. Training Assistant

Administration and Finance

S.K. Sinha ..... Senior Administrative Officer
D.C. Sahoo ..... Administrative Officer
..... (from 7 Sep 2009)

Projects and Financial Resources

Work Plan for 2009-10

Programme 1. Genetic Resources and Seed Technology: Leader: S.R. Dhua / B.C. Patra

Principal Investigators (PI)

B.C. Patra, H.N. Subudhi, B.C. Marndi, N.P. Mandal, N. Bhakta, S.R. Dhua, L. Behera, R.K. Sahu, Urmila Dhua, A. Prakash, Pramila Krishnan, P. Mishra, C.V. Singh and Annie Poonam

Co-PIs

H.N. Subudhi, B.C. Marndi, B.C. Patra, A. Patnaik, P.K. Sinha, R.K. Sahu, J.N. Reddy, S.S.C Patnaik, A. Prakash, S. Saha, Urmila Dhua, R.N. Rao, S.R. Dhua, L. Behera, Pramila Krishnan, Jagadiswari Rao, R.K. Singh and R.K. Sarkar

Programme 2: Genetic Enhancement of Yield: Leader: GJN Rao / R.N. Rao

Principal Investigators (PI)

P.K. Sinha, L.K. Bose, O.N. Singh, A. Patnaik, Bijoya Bhattacharjee, B.C. Marndi, D. Swain, G.J.N. Rao, J. Meher, J.N. Reddy, K. Pande, K. Chattopadhyay, K.S. Behera, L. Behera, M. Variar, M.J. Baig, Meera Kumari Kar, N. Bhakta, N.P. Mandal, Padmini Swain, P. Kaushal, R.N. Rao, Sanjukta Das, S.C. Sahu, S.K. Pradhan, S.K. Dash, S.S.C. Patnaik and V.D. Shukla

Co-PIs

A. Das, Pramila Krishnan, J. Meher, R.K. Sarkar, J.N. Reddy, S.C. Sahu, A. Patnaik, G. Bhaktavatsalam, S.S.C. Patnaik, A.K. Mishra, N. Bhakta, Bijoya Bhattacharjee, B.C. Marndi, D.P. Singh, K.R. Mahata, C.V. Singh, Gauri Padhi, G.J.N. Rao, G.N. Mishra, P.K. Sinha, L. Behera, J.N. Reddy, K. Chattopadhyaya, K. Pande, S.K. Pradhan, A. Ghosh, R.N. Dash, Padmini Swain, M.J. Baig, K.M. Das, A. Prakash, Mayabini Jena, L.K. Bose, Meera Kumari Kar, M. Variar, R.K. Singh, V.D. Shukla, N.P. Mandal, O.N. Singh, P.C. Rath, B.C. Patra, R.K. Sahu, R.K. Singh, R.N. Rao, P.N. Mishra, S. Sasmal, S. Saha, S.K. Pradhan, S.R. Dhua and Urmila Dhua

Programme 3: Improvement of Grain and Nutritional Quality: Leader: A. Patnaik / S.G. Sharma

Principal Investigators (PI)

A. Das, A. Patnaik, K. Chattopadhyay, S.G. Sharma and Sanjukta Das

Co-PIs

A. Das, Sanjukta Das, B.C. Marndi, P. Mishra, G.J.N. Rao, A. Shukla, K.S. Behera, S.N. Tewari, L. Behera, S.G. Sharma, A.K. Mishra, H.N. Subudhi, J.N. Reddy, P. Bhattacharya, S.C. Sahu and Pramila Krishnan

Programme 4: Breeding for Resistance/Tolerance to Biotic, Abiotic and Environmental Stresses: Leaders: J.N. Reddy / R.K. Sahu

Principal Investigators (PI)

A. Prakash, B.C. Marndi, D.P. Singh, G. Bhaktavatsalam, J. Meher, J.N. Reddy, K.M. Das, M.J. Baig, Meera Kumari Kar, Neeta Dwivedi, O.N. Singh, Pramila Krishnan, Padmini Swain, R.K. Sahu, R.K. Sarkar, S.K. Pradhan, S.K. Singh and V. Nandagopal

Co-PIs

A. Prakash, S.C. Sahu, K.M. Das, B. Ramakrishnan, K.S. Rao, D.P. Singh, G.J.N. Rao, G. Bhaktavatsalam,

S.K. Singh, Jagadiswari Rao, J. Mehar, V. Nandagopal, J.N. Reddy, K.R. Mahata, R.K Sarkar, B.C. Marndi, K.S. Behera, P.C. Rath, Mayabini Jena, M.J. Baig, Meera Kumari Kar, O.N. Singh, N.P. Mandal, P. Bhattacharya, Pramila Krishnan, Padmini Swain, R.K. Sahu, L. Behera, R.N. Rao, Sanjukta Das, S. Saha, S.K. Pradhan and Urmila Dhua

Programme 5: Natural Resource Management and Input Use Efficiency for Improved Crop Production: Leader: R.N. Dash / A. Ghosh

Principal Investigators (PI)

A. Ghosh, Annie Poonam, A.K. Shukla, B.B. Panda, B. Ramakrishnan, C.V. Singh, D. Maiti, D.P. Singh, K.S. Rao, P. Bhattacharya, P.C. Mohapatra, R.K. Singh, S. Lenka and T.K. Dangar

Co-PIs

A. Ghosh, A.K. Misra, A. Pandit, Annie Poonam, B. Ramakrishnan, B.B. Panda, B.C. Patra, C.V. Singh, K.M. Das, K.R. Mahata, K.S. Behera, K.S. Rao, Lipi Das, M. Din, M.J. Baig, Mayabini Jena, M. Variar, N. Bhakta, O.N. Singh, P. Samal, P. Bhattacharya, P.C. Mohapatra, Pramila Krishnan, Padmini Swain, R.K. Singh, R.N. Dash, R. Raja, S. Saha, Sanjukta Das, S.N. Tewari, S.P. Patel, T.K. Adhya, T.K. Dangar and V.D. Shukla

Programme 6: Enhancing and Sustaining the Productivity of Rice Based Farming Systems: Leader: K.S. Rao / A.K. Mishra

Principal Investigators (PI)

A. Ghosh, Annie Poonam, A.K. Misra, B.B. Panda, C.V. Singh, D.P. Sinhababu, K.R. Mahata, K.S. Rao, N. Bhakta, P. Bhattacharya, P.K. Nayak, R. Raja, S. Saha and S.M. Prasad

Co-PIs

A. Pandit, Annie Poonam, A.K. Misra, A.K. Shukla, B. Ramakrishnan, B.C. Marandi, B.C. Parida, B.C. Patra, D.P. Singh, D.P. Sinhababu, J. Meher, K.R. Mahata, K.S. Behera, K.S. Rao, Mayabini Jena, M. Nedunchenzhiyam, P. Bhattacharya, P.K. Nayak, Pramila Krishnan, P. Samal, R.K. Singh, R.N. Dash, R. Raja, R. Tripathi, S. Saha, S.G. Sharma, S. Lenka, S. Sasmal, T.K. Adhya, T.K. Dangar and U. Dhua

Programmme 7: Mechanization for Rice Production and Post-Harvest Systems: Leader: P.C. Mohapatra / P. Mishra

Principal Investigators (PI)

A.K. Choudhury, B.C. Parida, M. Din, P. Mishra and S.P. Patel

Co-PIs

A.K. Choudhury, K.S. Rao, M. Din, P.C. Mohapatra, B.C. Parida, S.P. Patel and S. Saha

Programme 8: Strategic Research on Pathogens/ Pest Population Dynamics, Crop Losses, Forecasting: Leader: Urmila Dhua / S. Sasmal

Principal Investigators (PI)

C.D. Misra, D. Maiti , G. Bhaktavatsalam, K.M. Das, M. Variar, P.C. Rath, S.K. Singh, S. Lenka, S.N. Tewari, S. Sasmal, Urmila Dhua, V. D. Shukla and V. Nandagopal

Co-PIs

A. Das, A. Prakash, B. Bhatttacharjee, B.C. Patra, D. Maiti, G. Bhaktavatsalam, J.N. Reddy, Jagadiswari Rao, K.M. Das, K.S. Behera, L. Behera, Mayabini Jena, S. Saha, S. Sasmal, S.C. Sahu, S.K. Singh, S.N. Tewari, Sanjukta Das, Urmila Dhua, V.D. Shukla and V. Nandgopal

Programme 9: Developing IPM Technologies for Different Rice Ecologies: Leader: Anand Prakash / S.N. Tewari

Principal Investigators (PI)

A. Prakash, C.D. Mishra, G. Bhaktavatsalam, Jagadiswari Rao, K.M. Das, K.S. Behera, Mayabini Jena, P.C. Rath, S. Sasmal, S.K. Singh, S. Lenka, S.N. Tewari and V.D. Shukla

Co-PIs

A. Das, Annie Poonam, A. Prakash, A.K. Shukla, C.D. Mishra, G. Bhaktavatsalam, G.A.K. Kumar, Jagadiswari Rao, K.M. Das, K.S.Behera, Mayabini Jena, P. Samal, P.C. Rath, Padmini Swain, R.N. Rao, S. Saha, S.C. Sahu, S.K. Singh, S.N. Tewari, V.D. Shukla, S. Saha, S. Sasmal, T.K. Dangar, Urmila Dhua and V. Nandagopal

Programme 10: Socio-Economic Research for Sustainable Development: Leader: N.C. Rath / P. Samal

Principal Investigators (PI)

A. Pandit, G.A.K. Kumar, Lipi Das, N.C. Rath, P. Samal and S.M. Prasad

Co-PIs

A.K. Choudhury, A. Pandit, B.C. Parida, D.P. Sinhababu, G.A.K. Kumar, H.N. Subudhi, K.M. Das, K.S. Rao, Lipi Das, N.C. Rath, O.N. Singh, P.C. Rath, P. Samal, R.N. Rao, S.K. Pradhan, S.M. Prasad, S.N. Tewari, S.R. Dhua, S.S.C. Pattnaik and S. Saha

Ongoing Externally Aided Projects (EAPs)

Number	Title of the Project	Principal Investigator	Source of Funding
EAP 27	Revolving fund scheme for seed production of upland rice varieties at CRURRS, Hazaribag	P.K. Sinha	AP Cess
EAP 36	National Seed Project (Crops)	S.R. Dhua	NSP
EAP 49	Revolving fund scheme for breeder seed production	S.R. Dhua	NSP
EAP 60	Frontline demonstration under micro-management scheme of Ministry of Agriculture-New high yielding rice varieties	V.D. Shukla	DSE / AICRIP
EAP 80	Upland shuttle breeding network program at Hazaribag (coordinating unit)	P.K. Sinha	ICAR-IRRI
EAP 83	DUS Testing and documentation	S.R. Dhua	PPV&FRA
EAP 93	Network project on gene pyramiding for resistance to multiple biotic stress in crops	G.J.N. Rao	ICAR Network
EAP 98	FLD of self-propelled rice transplanter, tractor operated rotary (lug wheel) puddler and animal drawn lug wheel puddler	S.P. Patel	Central Sector Scheme of DAC
EAP 99	Transgenic in crops	G.J.N. Rao	ICAR Network
EAP 100	Seed production in agricultural crops and fisheries– mega seed project	S.R. Dhua	ICAR
EAP 102	FLD under Macro-Management Scheme of Ministry of Agriculture—New high-yielding rice varieties	S.R. Dhua	AICP
EAP 104	Microbial diversity and identification	T.K. Adhya (CCPI T.K. Dangar)	ICAR Network

Number	Title of the Project	Principal Investigator	Source of Funding
EAP 105	Nutrient management	T.K. Adhya	ICAR Network
EAP 106	Microbial bioremediation	T.K. Adhya	ICAR Network
EAP 107	High temperature stress effects and associated biophysical changes in rice *Oryza sativa* L.	Pramila Krishnan	DST
EAP 108	Developing and disseminating resilient and productive rice varieties for drought prone areas on India - Hazaribag	P.K. Sinha	IRRI (RF & GCP), ICAR
EAP 112	Development and dissemination of water saving rice technologies in South Asia	O.N. Singh	ADB (DARE / ICAR)
EAP 113	Bio-intensive management of rice pests with emphasis on botanicals	Mayabini Jena	DST
EAP 114	Iron metabolism in rice (*Oryza sativa* L) plant with emphasis on its translocation and assimilation	A. Das	DST
EAP 118	Detecting and fine-mapping QTLs with major effects on rice yield under drought stress for deployment via marker-aided breeding	Padmini Swain	IRRI (GCP), ICAR
EAP 119	Soil organic carbon dynamics vis'-a'-vis' anticipatory climatic changes and crop adaptation strategies	T.K. Adhya	ICAR (NAIP)
EAP 120	Towards development of a single cell C4 photosynthetic system in rice	M.J. Baig	ICAR (NAIP)
EAP 121	Developing Sustainable Farming System Models for Prioritized Micro-watershed in Rainfed Areas in Jharkhand	R.K. Singh	ICAR (NAIP)
EAP 122	Allele mining and expression profiling of resistance-and avirulence genes in rice blast pathosystem for development of race non-specific disease resistance	M. Variar	ICAR (NAIP)
EAP 123	Enhancing and stabilizing productivity of salt affected areas through incorporation of genes for tolerance of abiotic stresses in rice	D.P. Singh	IRRI (BMZ)–ICAR
EAP 124	Microbiological and chemical characterization of water before and after treatment with rice husk ash (RHA) filters of different quality	B. Rama-krishnan	DST, GOI
EAP 125	Stress tolerant rice for poor farmers of Africa and South Asia–Drought prone rainfed rice areas of South Asia–Hazaribag Centre	P.K. Sinha	ICAR-IRRI (BMGF)
EAP 126	Stress tolerant rice for poor farmers of Africa and South Asia-Drought prone areas-CRRI Centre	O.N. Singh	ICAR-IRRI (BMGF)
EAP 127	Stress tolerant rice for poor farmers of Africa and South Asia-Submergence and Flood prone areas	J.N. Reddy	ICAR–IRRI (BMGF)
EAP 128	Stress tolerant rice for poor farmers of Africa and South Asia-Saline-prone areas	D.P. Singh	ICAR–IRRI (BMGF)
EAP 129	Stress tolerant rice for poor farmers of Africa and South Asia-Socio-economic survey and impact assessment	P. Samal	ICAR-IRRI (BMGF)

Number	Title of the Project	Principal Investigator	Source of Funding
EAP 130	All India Network Project on Soil Biodiversity-Biofertilizers	T.K. Adhya	ICAR Network Project
EAP 131	Research into development of decision support system for major insects pests or rice and cotton	R.C. Dani / M. Jena	NAIP
EAP 132	Gender issues of rice based production system and refinement of selected technologies in women perspective	Lipi Das	Network, DRWA
EAP 133	Capitalization of prominent landraces of rice in Orissa through value chain approach	A. Patnaik	NAIP
EAP 134	Development and maintenance of rice knowledge management portal	G.A.K.Kumar	NAIP
EAP 135	Bioprospecting of genes and allele mining for abiotic stress tolerance	G.J.N. Rao	NAIP
EAP 136	FLD under Macro-management Scheme of Ministry of Agriculture-New high yielding rice varieties–Hazaribag	V.D. Shukla	AICRP
EAP 137	Establishment of National Rice Resource Database	B.C. Patra	DBT

Financial Statement for 2009-10 (Indian ` in lakhs)
(As on 31 Mar 2010)

	Plan		Non-Plan	
Head of Account	Allocation	Expenditure	Allocation	Expenditure
Estt. Charges (including wages)	0	0	2,303.18	2,297.24
TA (including HRD)	27.00	27.00	9.74	9.74
OTA	0	0	0.20	0.20
Other Charges (including I.T.)	415.00	415.00	140.68	140.68
Works (Major / R&M)	60.00	60.00	59.76	59.75
Total	502.00	502.00	2,513.56	2,507.61
Revenue Generated: ` 65.12 lakhs				

Weather

At CRRI, Cuttack

	Temperature (°C)		Relative humidity (%)		Rainfall	Evaporation	Sunshine
	Max	Min	RH I	RH II	(mm)	(mm)	(h / day)
Apr 2009	36.9	24.8	91.2	44.7	0	5.2	7.2
May 2009	35.6	25.6	87.4	54.7	217.9	5.7	7.3
Jun 2009	36.9	26.5	84.9	55.8	63.1	5.5	5.6
Jul 2009	30.5	26.2	91.9	78.8	526.2	4	1.6
Aug 2009	32	26.6	92	73.8	318.4	4.1	2.6
Sep 2009	32.1	26.2	93.3	76.2	311.9	4.2	4
Oct 2009	31.3	22.8	91.1	56.0	81.4	4	6.8
Nov 2009	29.7	20.2	91.1	54.9	53.6	4	6.4
Dec 2009	28	15.9	95.4	44.6	0	3.8	6.7
Jan 2010	26.5	15	92.3	43.5	1.4	3.8	6.5
Feb 2010	31.2	19.3	96.4	40.1	0	4.1	6.8
Mar 2010	34.9	24.5	92	47.1	10.2	4.8	5.9

At CRURRS, Hazaribagh

	Temperature (°C)		Relative humidity (%)		Rainfall	Evaporation	Sunshine
	Max	Min	RH I	RH II	(mm)	(mm)	(h / day)
Apr 2009	37.3	19.7	0	32.1	23.6	10.2	10.3
May 2009	36.4	22.5	120.9	45.7	34.4	8.3	8.9
Jun 2009	36.7	23.8	66	56	36.2	6.8	8.9
Jul 2009	30.2	23.5	255.8	85.9	73.2	1.1	4.2
Aug 2009	30.8	23.4	208.2	84.9	71.5	1	4.5
Sep 2009	30.8	22.4	372.2	82.3	67	3	6.3
Oct 2009	29	16.3	69.4	73.4	51.1	3.2	7.7
Nov 2009	26.3	12.7	52.4	64	43.3	2.7	7.9
Dec 2009	25.1	7.6	2.6	75.9	49	1.9	8.4
Jan 2010	22.6	5.2	0	78.5	41.2	2.5	8.3
Feb 2010	27.1	10.3	2	56.8	32.4	3.7	8.5
Mar 2010	34.3	16	0	38	17.8	6.3	9.2

At RRLRRS, Gerua

	Temperature (°C)		Relative humidity (%)		Rainfall	Evaporation	Sunshine
	Max	Min	RH I	RH II	(mm)	(mm)	(h / day)
Apr 2009	31.2	18.1	85.4	73.2	46.8	3.6	7.4
May 2009	33.1	22	88	75.3	130.6	3.6	7.5
Jun 2009	35	24.3	86.8	71.7	200	3.5	5.9
Jul 2009	34.8	25.1	84.2	71.1	276.9	4	4.6
Aug 2009	33.6	24.8	86.6	76.1	341.9	3.1	5
Sep 2009	34	24.2	87	75.3	71.8	3.3	6.9
Oct 2009	32.4	21.2	90.5	76.1	119.4	3.2	6.9
Nov 2009	28.9	15.3	90.5	86.8	5.6	2.9	7.1
Dec 2009	25.5	11.3	96	81.4	4.2	2.9	5.8
Jan 2010	24.5	8.5	93.4	75.4	0	2.8	5.9
Feb 2010	27.7	9.3	84.5	79.6	0	3.3	6.4
Mar 2010	31.7	15.3	84.6	73.5	132	3.8	6.5

Ravi Viswanathan

Acronyms

AAU	:	Assam Agricultural University
ACIAR	:	Australian Centre for International Agricultural Research
ADB	:	Asian Development Bank
ADG	:	Assistant Director-General
AICRIP	:	All India Coordinated Rice Improvement Project
AIR	:	All India Radio
AMAAS	:	Application of Microorganisms in Agriculture and Allied Sectors
ANGRAU	:	Acharya N.G. Ranga Agricultural University, Hyderabad
ARIS	:	Agricultural Research Information Service
AROMA	:	Orissa Millers' Association
ASG	:	Aromatic Short Grain
ASGON	:	Aromatic Short Grain Observation Nursery
ASRB	:	Agricultural Scientists Recruitment Board, New Delhi
ASV	:	Alkali Spreading Value
ATMA	:	Agricultural Technology Management Agency
AVT	:	Advanced Varietal Trial
AWD	:	Alternate Wetting and Drying
AYT	:	Advance Yield Trial
AZRA	:	Applied Zoologists Research Association, Cuttack
BARC	:	Bhabha Atomic Research Centre, Mumbai
BAU	:	Birsa Agricultural University, Ranchi
BB/BLB	:	Bacterial Leaf Blight
BCKV	:	Bidhan Chandra Krishi Viswavidyalaya
BMGF	:	Belinda and Bill Gates Foundation
BMZ	:	Germany's Federal Ministry for Economic Cooperation and Development
BPH	:	Brown Planthopper
BRRI	:	Bangladesh Rice Research Institute, Gazipur
Bt	:	*Bacillus thuringiensis*
CAC	:	Consortium Advisory Committee
CARI	:	Central Avian Research Institute
CGIAR	:	Consultative Group on International Agricultural Research
CIAE	:	Central Institute of Agricultural Engineering, Bhopal
CIC	:	Consortium Implementation Committee
CIFA	:	Central Institute of Freshwater Aquaculture, Bhubaneswar
CIPHET	:	Central Institute of Post Harvest Engineering and Technology, Ludhiana
CMS	:	Cytoplasmic Male Sterile / Sterility
CPCRI	:	Central Plantation Crop Research Institute, Kasargod
CRIDA	:	Central Research Institute for Dryland Agriculture, Hyderabad
CRIJAF	:	Central Research Institute for Jute and Allied Fibres, Barrackpore
CRRI	:	Central Rice Research Institute, Cuttack
CRURRS	:	Central Rainfed Upland Rice Research Station, Hazaribag
CSIR	:	Council of Scientific and Industrial Research
CURE	:	Consortium for Unfavourable Rice Environment

DAC	:	Department of Agriculture and Cooperation
DAF	:	Days after Flowering
DAH	:	Days after Harvest
DAO	:	District Agricultural Officer
DARE	:	Department of Agriculture Research and Education, Government of India
DAS	:	Days after Sowing
DBN	:	Drought Breeding Network
DBT	:	Department of Biotechnology, New Delhi
DDA	:	Deputy Director of Agriculture
DFF	:	Days to 50% Flowering
DH	:	Dead Hearts
DIPA	:	Directorate of Information and Publications of Agriculture, ICAR, New Delhi
DNA	:	Deoxyribonucleic Acid
DRD	:	Directorate of Rice Development, Patna
DRR	:	Directorate of Rice Research, Hyderabad
DRWA	:	Directorate of Research for Women in Agriculture
DS	:	Dry Season
DSN	:	Dry Season Nursery
DSR	:	Directorate of Seed Research, Mau
DST	:	Department of Science and Technology, New Delhi
DVS	:	Development rate for Vegetative Stage
EAP	:	Externally Aided Projects
EC/ECe	:	Electrical Conductivity
EIRLSBN	:	Eastern India Rainfed Lowland Shuttle Breeding Network
FLD	:	Frontline Demonstration
FYM	:	Farmyard Manure
g	:	Gram
GBPUAT	:	Govind Ballabh Pant University of Agriculture and Technology, Pantnagar
GLH	:	Green Leafhopper
GM	:	Green Manuring / Gall Midge
h	:	Hour
ha	:	Hectare
HAU	:	Haryana Agricultural University, Hisar
HI	:	Harvest Index
HRR	:	Head Rice Recovery
HYV	:	High Yielding Variety
IAEA	:	International Atomic Energy Agency
IARI	:	Indian Agricultural Research Institute, New Delhi
IASRI	:	Indian Agricultural Statistics Research Institute, New Delhi
ICAR	:	Indian Council of Agricultural Research
ICRISAT	:	International Crops Research Institute for the Semi-Arid Tropics
IDM	:	Integrated Disease Management
IET	:	Initial Evaluation Trial
IFAD	:	International Fund for Agricultural Development
IGAU	:	Indira Gandhi Agricultural University, Raipur
IGKVV	:	Indira Gandhi Krishi Vishwavidyalaya
IINRG	:	Indian Institute of Natural Resins and Gums, Ranchi
IISS	:	Indian Institute of Soil Science, Bhopal
IIVR	:	Indian Institute of Vegetable Research, Varanasi
IJSC	:	Institute Joint Staff Council
IMC	:	Institute Management Committee
INGER	:	International Network for Genetic Evaluation of Rice

INM	:	Integrated Nutrient Management
INSA	:	Indian National Science Academy
IPM	:	Integrated Pest Management
IPR	:	Intellectual Property Rights
IPS	:	Indian Police Service
IRRI	:	International Rice Research Institute, Philippines
IVRI	:	Indian Veterinary Research Institute, Izatnagar
IVT	:	Initial Varietal Trial
JNKVV	:	Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur
kg	:	Kilogram
KVK	:	Krishi Vigyan Kendra
l	:	Litre
LB	:	Long-bold
LCC	:	Leaf Colour Chart
LF	:	Leaf Folder
LS	:	Long-slender
LSI	:	Location Severity Index
MANAGE	:	National Institute of Agriculture Extension and Management, Hyderabad
MAS	:	Marker-assisted Selection
MB	:	Medium Bold
MLT	:	Multilocation Trial
MR	:	Moderately Resistance
MS	:	Medium-slender
MSSRF	:	MS Swaminathan Research Foundation, Chennai
NAARM	:	National Academy of Agricultural Research Management, Hyderabad
NAAS	:	National Academy of Agricultural Sciences
NABARD	:	National Bank for Agriculture and Rural Development
NAIP	:	National Agricultural Innovation Project
NARES	:	National Agricultural Research and Extension Research
NARS	:	National Agricultural Research System
NASC	:	National Agricultural Science Complex, New Delhi
NBAIM	:	National Bureau of Agriculturally Important Microorganisms
NBPGR	:	National Bureau of Plant Genetic Resources, New Delhi
NBRI	:	National Botanical Research Institute, Lucknow
NDRI	:	National Diary Research Institute, Karnal
NDUAT	:	Narendra Dev University of Agriculture and Technology
NFSM	:	National Food Security Mission
NGO	:	Non-governmental Organization
NHSN	:	National Hybrid Screening Nursery
NIL	:	Near-isogenic Lines
NIPGR	:	National Institute for Plant Genome Research, New Delhi
NIWS	:	National Invasive Weed Surveillance
NPK	:	Nitrogen, Phosphorus, Potassium
NPT	:	New Plant Type
NRC	:	National Research Centre
NRCPB	:	National Research Centre for Plant Biotechnology, New Delhi
NRRP	:	National Rice Research Programme, Nepal
NSN	:	National Screening Nursery
NSP	:	National Seed Project
NUE	:	Nitrogen-use Efficiency
OFT	:	On-farm Trials

OUAT : Orissa University of Agriculture and Technology, Bhubaneswar

OYT : Observational Yield Trial

PAU : Panjab Agricultural University, Ludhiana

PDCSR : Project Directorate for Cropping System Research, Meerut

PE : Panicle Emergence

PI : Panicle Initiation

PMYT : Preliminary Multilocational Yield Trial

PVS : Participatory Varietal Selection

PYT : Preliminary Yield Trial

q : Quintal

QTL : Quantitative Trait Loci

RAC : Research Advisory Committee

RAPD : Random Amplification of Polymorphic DNA

RARS : Regional Agricultural Research Station

RBC : Rice-based Cropping System

RBD : Randomized Block Design

RCC : Reinforced Cement Concrete

RFLP : Restriction Fragment Length Polymorphism

RH : Relative Humidity

RIL : Recombinant Inbred Line

RRLRRS : Regional Rainfed Lowland Rice Research Station, Gerua

RTBV : Rice Tungro Baciliform Virus

RTV / RTD : Rice Tungro Virus / Disease

RYP : Replicated Yield Trial

SABRAO : Society for Advancement in Breeding Research in Asia and Oceania

SAC : Scientific Advisory Committee

SATVT : Saline Alkaline Tolerant Varietal Trial

SAU : State Agricultural University

SB : Short-bold

SBN : Salinity Breeding Network

SES : Standard Evaluation System

SLA : Specific Leaf Area

SOC : Soil Organic Carbon

SRC : Scientific Research Council

SRI : System of Rice Intensification

SS : Silver Shoots

STRASA : Stress Tolerant Rice for Poor Farmers in Africa and South Asia

t : Tonne

TDM : Total Dry Matter

TNAU : Tamil Nadu Agricultural University, Coimbatore

UAP : Urea Ammonium Phosphate

UBN : Uniform Blast Nursery

URSBN : Upland Rice Shuttle Breeding Network

USG : Urea Super Granule

UV : Ultraviolet

WALMI : Water and Land Management Institute, Cuttack

WBPH : White-backed Plant Hopper

WCE : Weed Control Efficiency

WEH : White Ear Heads

WS : Wet Season

WTCER : Water Technology Centre for Eastern Region, Bhubaneswar

WTO : World Trade Organization

WUE : Water-use Efficiency

YMV : Yellow Mosaic Virus

YSB : Yellow Stem Borer

ZPD : Zonal Project Directorate

All good wishes to the Rice Institute — first of its kind in India, in Asia and in the world. May it solve the problems that afflict us in rural India.

Jawaharlal Nehru

April 13, 1968

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