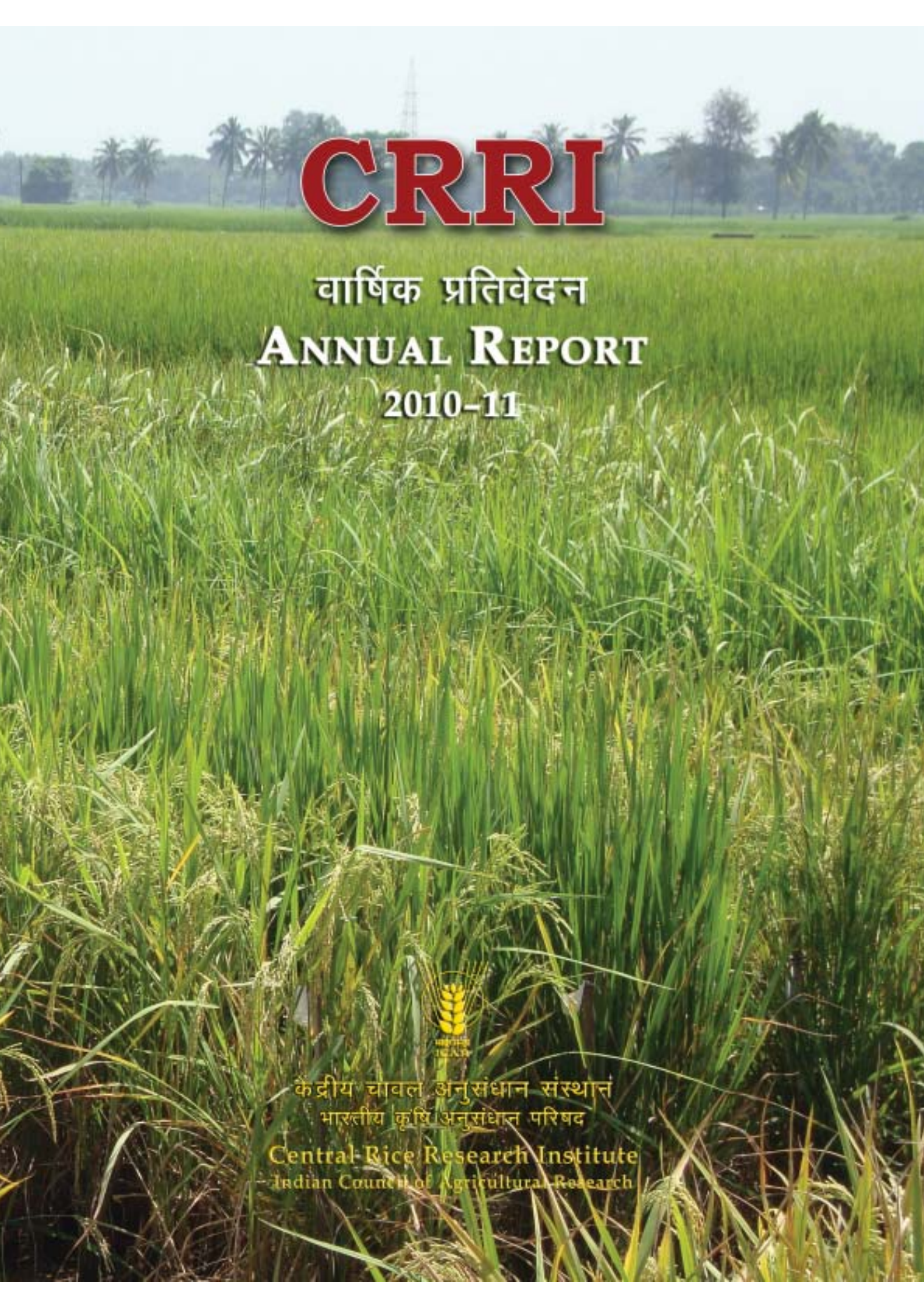

CRRI

वार्षिक प्रतिवेदन

ANNUAL REPORT

2010-11

केंद्रीय चावल अनुसंधान संस्थान
भारतीय कृषि अनुसंधान परिषद

Central Rice Research Institute
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कटक (उड़ीसा) ७५३ ००६, भारत

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

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Cover 1, 4: The CRRI has been developing, evaluating and testing various lines for different ecologies. Seen in the photograph are lines in the experimental fields in Cuttack. (Photo: Ravi Viswanathan)

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Preface

FLUCTUATIONS in the precipitation during the monsoon are now an accepted fact. During the last five years, rainfall varied from 77% of the long period average (LPA) in 2009 to 106% of LPA in 2007. Such high variability gave an opportunity for the CRRI to develop climate resilient rice varieties, and to evaluate its lines and varieties under development. These efforts have resulted in the development of the first long duration hybrid CR Dhan 701 (CRHR32). This has been recommended for release in the shallow lowlands of Bihar and Gujarat. Various other varieties such as CR Dhan 601, CR Boro Dhan 2, CR Dhan 401 and hybrid CRHR 5 were also recommended for release.

The CRRI is now the Nodal Agency for scientific monitoring and technical backstopping in connection with the implementation of the Government of India project "Bringing Green Revolution to Eastern India (BGREI)" under the Rashtriya Krishi Vikas Yojana. This project envisages specific interventions to ameliorate the cultivation constraints of the farmers in selected districts in eastern India.

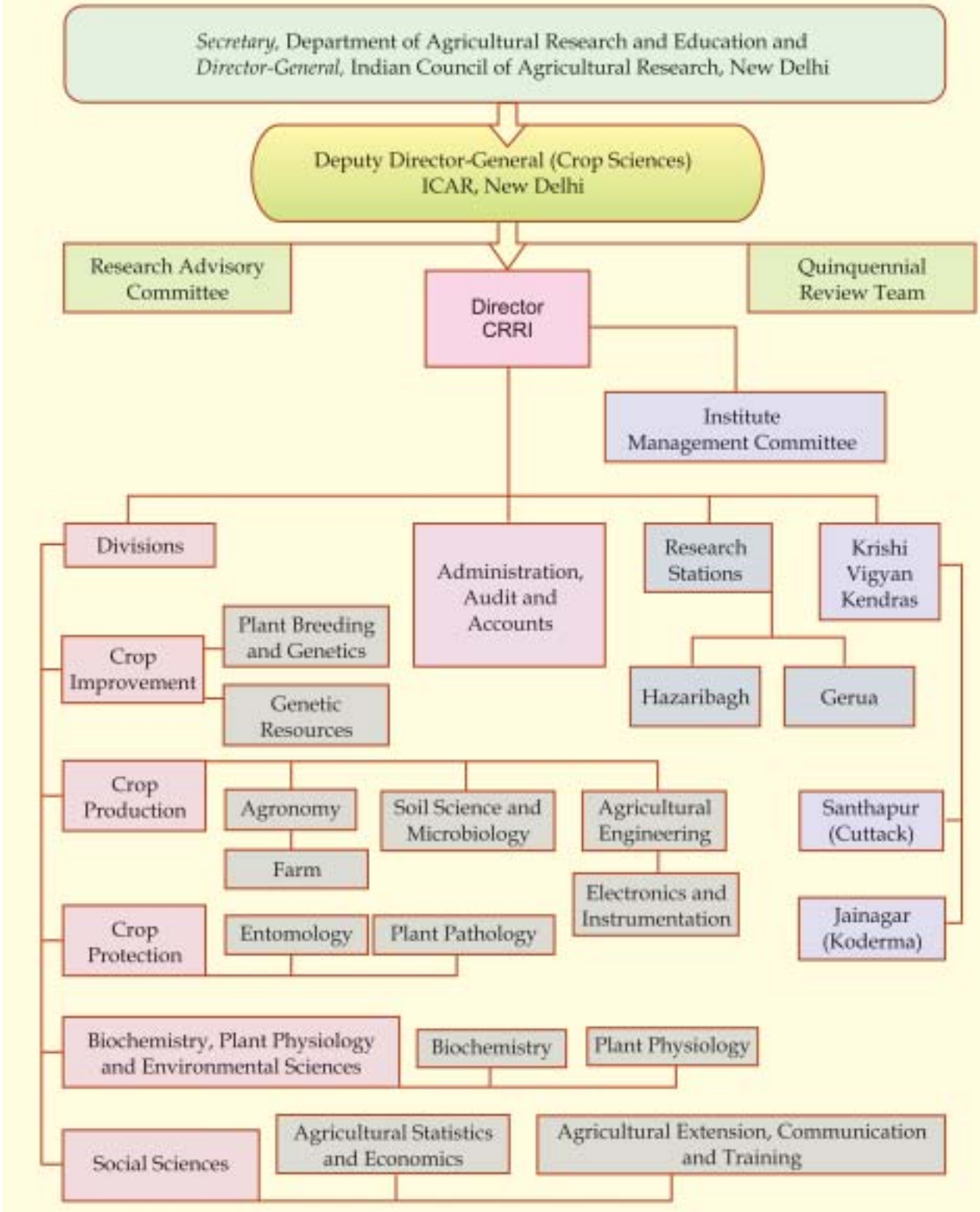
The CRRI has also been upgrading its facilities at Cuttack as well as its Research Stations and Krishi Vigyan Kendras with state-of-the-art equipments. This will enable it to face the challenges of biotic and abiotic stresses, and the environmental changes.

This report presents the salient research findings. I am sure that this Annual Report will be useful for Research Managers, Researchers, Farmers and Students.

(T.K. Adhya)
Director

Organogram of

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



Contents

कार्यकारी सारांश
Executive Summary

CR Dhan 601 (IET 18558; CRG 1190-1) was identified for cultivation in *boro* areas of Orissa, West Bengal and Assam. It yields 5.5 to 7.2 t/ha in 160 days. It is resistant to leaf blast and RTV and is moderately resistant to brown spot and sheath rot.

CR Boro Dhan 2 (IET 17612; CR 898) was identified for *boro* areas of Orissa and Assam. It has medium slender grains with HRR of 66% and 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.

CR Dhan 401 (IET 19969; CR 780-1937-1-3) exhibited yield superiority over Savitri and regional check varieties particularly under late duration/shallow lowland conditions. It was identified for cultivation in shallow lowlands areas of Orissa and West Bengal in region 3, and in Tamil Nadu and Andhra Pradesh in region 5. It yields 5.4 t/ha in 150 days. It has medium slender grains with good grain quality traits. It is resistant to stem borer and LH and is moderately tolerant to GLH, WBPH, rice thrips and EHB.

Hybrid CRHR 5 was identified for cultivation in the boro in Assam and Orissa.

The first long duration hybrid CR Dhan 701 (CRHR 32) was identified for cultivation in Bihar and Gujarat in shallow lowlands. It had significant yield superiority over Savitri, Pooja and local.

More than 502 germplasm accessions were characterized for morpho-agronomic characteristics.

Breeder seed and nucleus seeds of different varieties were produced.

Elite line CRR 455-109 (IET 20863) was most promising for drought-prone rainfed upland of Jharkhand.

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

Breeding materials were generated to overcome deficiencies in nutrients.

उड़ीसा, पश्चिम बंगाल तथा असम के *बोरो* क्षेत्रों में खेती के लिए सीआर धान ६०१ (आईईटी १८५५८; सीआरजी ११९०-१) किस्म की पहचान की गई। इससे १६० दिनों में ५.५ से ७.२ टन प्रति हैक्टर की उपज प्राप्त होती है। यह पत्ता प्रध्वंस तथा राइस टुंग्रो वायरस प्रतिरोधी है एवं भूरा धब्बा और आच्छद विगलन के प्रति मध्यम प्रतिरोधी है।

उड़ीसा तथा असम के *बोरो* क्षेत्रों में खेती के लिए सीआर बोरो धान २ (आईईटी १७६१२; सीआर ८९८) किस्म की पहचान की गई। इसका दाना मध्यम पतला है, ६६ प्रतिशत सेला चावल प्राप्त होता, इससे १५० दिनों में ६ टन प्रति हैक्टर की उपज प्राप्त होती है। सीआर बोरो धान प्रध्वंस के प्रति प्रतिरोधी/मध्यम प्रतिरोधी है, जीवाणुज पत्ता अंगमारी, आच्छद अंगमारी प्रतिरोधी है एवं पीला तना छेदक सहिष्णु है।

सीआर धान ४०१ (आईईटी १९९६९; सीआर ७८०-१९३७-१-३) किस्म से सावित्री तथा स्थानीय चेक किस्मों की अपेक्षा विलंबित अवधि/उथली निचली भूमियों में बेहतर उपज प्राप्त हुई। उड़ीसा तथा पश्चिम बंगाल के उथली निचली भूमियों के क्षेत्र ३ में तथा तमिल नाडु एवं आंध्र प्रदेश के क्षेत्र ५ में खेती करने के लिए इसकी पहचान की गई। इससे १५० दिनों में ५.४ टन प्रति हैक्टर की उपज प्राप्त होती है। इसका दाना मध्यम पतला है तथा अनाज के गुण अच्छे हैं। पीला तना छेदक एवं पत्ता माहू प्रतिरोधी है और हरा पत्ता माहू, सफेद पीठवाला पौध माहू, राइस थ्रीप्स् एवं ईएचबी के प्रति मध्यम रूप से सहिष्णु है।

असम तथा उड़ीसा में बोरो के दौरान खेती करने के लिए संकर सीआरएचआर ५ किस्म की पहचान की गई।

बिहार तथा गुजरात के उथली निचली भूमियों में खेती करने के लिए सर्वप्रथम लंबी अवधि वाली संकर सीआर धान ७०१ (सीआरएचआर ३२) किस्म की पहचान की गई। सावित्री, पूजा तथा स्थानीय किस्म की अपेक्षा इससे बेहतर उपज प्राप्त हुई।

५०२ से अधिक जननद्रव्यों का कृषि-आकारिकी विशेषताओं के लिए लक्षण वर्णन किया गया।

विभिन्न किस्मों के प्रजनक बीज तथा केंद्रक बीज का उत्पादन किया गया।

झारखंड के सूखा-प्रवण वर्षाश्रित ऊपरीभूमियों के लिए श्रेष्ठ वंश सीआरआर ४५५-१०९ (आईईटी २०८६३) आशाजनक पाया गया।

विभिन्न पारिस्थितिकियों में राष्ट्रीय (एआईसीआरपी) परीक्षणों के तहत कई प्रविष्टियों का परीक्षण किया गया।

पोषकों की कमियों को दूर करने के लिए प्रजनन सामग्रियां विकसित की गईं।

बाढ़-पूर्व (*आहु*), बाढ़-पश्चात (*साली*) तथा आचनक आने वाली बाढ़ परिस्थिति के लिए कई जीनप्ररूपों का मूल्यांकन किया गया।

Various genotypes were evaluated for pre-flood (*ahu*), post-flood (*sali*) and flash flood.

Hybrid seeds of 17 combinations were produced.

CR 2616 (IET 21044) was promoted to fourth year of testing on the basis of overall performance and quality.

CR 2613 (IET-21271) was promoted to third year of evaluation.

CR 2713 (IET 21840) and CR 2711 (IET 21833) with superior yield performance over checks were promoted to second year of testing

Screening was done to identify new sources of resistant / tolerance to blast, BLB, sheath blight and RTV.

The long-term pesticide trial was continued to evaluate the performance of chemicals.

New insect molecule against insect pests of rice was tested.

An IPM module for upland rice was formulated.

A study on the extent of adoption of CRRI rice varieties in Khandaita cluster of Cuttack Sadar block of Cuttack district was conducted.

The Krishi Vigyan Kendras of Santhapur and Koderma conducted various training programmes, on-farm trials and frontline demonstrations.

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

The 64th Foundation Day of the CRRI, and Annual Review and Planning meetings of various projects were held.

The Hindi Fortnight 2010 and the Vigilance Awareness Week 2010 were conducted.

सत्रह मिश्रणों के संकर बीजों का उत्पादन किया गया।

समग्र निष्पादन तथा गुणवत्ता के आधार पर सीआरआर २६१६ (आईईटी २१०४४) किस्म को परीक्षण के चौथे वर्ष के लिए आगे बढ़ाया गया।

सीआरआर २६१३ (आईईटी २१२७१) किस्म को मूल्यांकन के तीसरे वर्ष के लिए आगे बढ़ाया गया।

स्थानीय चेक किस्मों की अपेक्षा में सीआरआर २७१३ (आईईटी २१८४०) तथा सीआरआर २७११ (आईईटी २१८३३) की उपज बेहतर पाई गई तथा परीक्षण के दूसरे वर्ष के लिए आगे बढ़ाया गया।

प्रध्वंस, जीवाणुज पत्ता अंगमारी, आच्छद अंगमारी तथा राइस टुंग्रो वायरस के प्रति प्रतिरोधी/सहिष्णु के नए स्त्रोतों की पहचान करने के लिए परीक्षण किए गए।

रसायनों के निष्पादन का मूल्यांकन करने के लिए दीर्घकालिक कीटनाशक परीक्षण को जारी रखा गया।

चावल के नाशककीटों के विरुद्ध नई कीट मोलिक्यूल का परीक्षण किया गया।

ऊपरीभूमि चावल के लिए एक समन्वित कीट प्रबंधन मॉड्यूल का विकास किया गया।

कटक जिले के कटक सदर प्रखंड के खंडैत समूह गांवों में सीआरआरआई चावल किस्मों को अपनाने की सीमा पर एक अध्ययन किया गया।

कृषि विज्ञान केंद्र, संथपुर तथा कृषि विज्ञान केंद्र, कोडरमा द्वारा किसानों के खेतों में कई प्रशिक्षण कार्यक्रमों तथा अग्रिम पंक्ति प्रदर्शनों का आयोजन किया गया।

अनुसंधान सलाहकार समिति (आरएसी), संस्थान प्रबंधन समिति, संस्थान संयुक्त कर्मचारी परिषद (आईजेएससी), संस्थान अनुसंधान परिषद (आईआरसी) तथा कृषि विज्ञान केंद्र वैज्ञानिक सलाहकार समिति (एसएसी) की बैठकें आयोजित की गईं।

सीआरआरआई की ६४वीं स्थापना दिवस समारोह मनाया गया एवं कई परियोजनाओं की वार्षिक समीक्षा तथा योजना बैठकें आयोजित की गईं।

हिंदी पखवाड़ा २०१० तथा सतर्कता जागरूकता सप्ताह २०१० मनाया गया।

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 CRURRS, Hazaribag was established to tackle the problems of rainfed uplands, and the RRLRRS, 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, trainers 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 82 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

Collection, Characterization and Conservation of Trait Specific Germplasm

An exploration and collection programme of rice germplasm for cold tolerant rice was done in Arunachal Pradesh from 30 Nov to 6 Dec 2010. Fiftysix germplasm were collected from the districts of East Siang, Pasighat, Itanagar, Papum Pare and West Kamang of Arunachal Pradesh and also in districts of Sonitpur and Dhemaji in upper Assam.

Characterisation and Rejuvenation of Rice Germplasm

During *kharif* 2010, 502 germplasm accessions were characterized for morpho-agronomic characters (IRRI-IBPGR Descriptors).

DFF: From 71 (AC 35367) to 145 (AC 352236).

Leaf length: From 23 cm (AC 36747) to 86.6 cm (AC 35573).

Leaf width: From 0.4 cm (AC 35772) to 2.06 cm (AC 35176).

Ligule length: From 0.76 cm (AC 35755) to 3.4 cm (AC 35351).

Plant height: From 72.6 cm (AC 35738) to 201.6 cm (AC 35263).

Culm number: From 5.6 (ac36466) to 17 (AC 35173).

Panicle length: From 14.5 cm (AC 36880) to 32.1 (AC 35202).

Long panicles >30 cm: AC 35344, AC 35248, AC 35030, AC 35351, AC 35803.

One thousand germplasm accessions were transplanted for rejuvenation.

Conservation of Rice Germplasm and Development of Database for Genetic Resources Management and Seed Supply

Three thousand seven hundred and eighteen accessions of rice germplasm and 100 accessions of wild rice (*O. nivara* and *O. rufipogon*) were conserved in three layered aluminum pouches at CRRI gene bank.

Two thousand nine hundred and ninetysix acces-

Table 1. Quantity of nucleus and breeder seed produced during the year.

Variety	Quantity of seeds (t)	
	Nucleus seed	Breeder seed
Lunishree	0.15	0.63
Savitri (CR 1009)	0.09	3.4
CR 1014	0.06	0.75
Gayatri (CR 1018)	0.09	0.78
Dharitri (CR 1017)	0.03	0.69
Utkal Prabha (CR 1030)	0.06	1.1
Geetanjali	0.08	0.33
Sarala	0.12	2.2
Pooja	0.21	6.6
Ketekijoha	0.03	0.15
Moti	0.06	0.24
Nua Kalajeera	0.06	2.6
Padmini	0.06	0.3
Varshadhan	0.18	2.3
CR Dhan 10	0.06	0.96
CR Dhan 70	-	0.09
CR Sugandh Dhan 3	0.07	0.12
Swarna-*Sub1*	0.14	6.5
Durga	0.06	0.63
Sahabhagi Dhan	0.06	0.69
Annada	0.27	0.5
Khitish	0.15	1.1

Table 1. Quantity of nucleus and breeder seed produced during the year.

Variety	Quantity of seeds (t)	
	Nucleus seed	Breeder seed
IR 36	0.24	6
IR 64	0.15	2.3
Naveen	0.09	8.1
Ratna	0.06	1.2
Satabdi	0.09	4.1
IR 20	0.42	0.15
Chandan (CR Boro Dhan 2)	0.05	0.25
Heera	-	0.18
Samalei	-	0.4
Tapaswini	-	0.6

Table 1. Quantity of nucleus and breeder seed produced during the year.

Variety	Quantity of seeds (t)	
	Nucleus seed	Breeder seed
CR Dhan 401	-	0.5
CR Dhan 402	-	0.15
CR Dhan 501	-	0.42
CR Dhan 503	-	0.2
Nua Chinikamini (CR Dhan 901)	-	0.4
CR Dhan 601	-	0.33
Tulasi	-	0.15
Jaldi Dhan 6	-	0.18
Dhanarani	-	0.57
Ranjit	-	0.54

sions of rice germplasm were sent for conservation in the National Gene Bank at NBPGR, New Delhi.

Maintenance of Landraces, Identified Donors and Pre-breeding Lines for Upland Ecosystem

During *kharif* 2010, 104 genotypes comprising of landraces, identified donors for different traits and released varieties, were characterized for 23 different morphological characters at CRURRS, Hazaribag. DNA extraction from same set of 104 genotypes was completed.

Seed Production

The quantity of breeder seed and nucleus seed produces is given in Table 1.

Genetic Enhancement of Yield

Varietal Improvement for Rainfed Uplands

Development of Varieties Suitable For Uplands

Elite line identified: CRR 455-109 (IET 20863), an elite line derived from Kalinga III / WAB 56-50 was promising for drought-prone rainfed uplands of Jharkhand after three years of testing. In region 3, it yielded 1.7 to 2 t / ha in drought conditions that were about 21% higher than the national check variety Anjali and regional check Vandana. In *kharif* 2010 in AVT-VE it ranked first under both drought-affected and normal rainfall conditions. CRR 455-109 is resistant to brown spot, moderately resistant to leaf blast and highly tolerant to drought. It has high HRR of 68.6%, intermediate ASV of 5 and amylose content of 23.31%.

AICRIP trials

Based on performance in the initial variety trial, CRR 616-B-2-66-2, CRR 451-1-B-2-1, CRR 506-3, CRR 505-14-B-D1-RR1-B, CRR 646-B-93-B-3 and CRR 428-237-1-3-1 were promoted to AVT-VE under AICRIP.

Development of Aerobic Rice

Development of High-yielding Varieties for Limited Water Conditions

Advanced yield trial (AYT) under aerobic condition rabi *2010:* Thirtythree genotypes were evaluated during *rabi* 2010. The maturity duration of genotypes ranged from 102 days to 123 days. Promising genotypes were above 115 days except CR 2717-19-IR 84899-B-184. The maturity duration of check varieties ranged from 110 to

CRR 455-109 (IET 20863), an elite line derived from Kalinga III/WAB 56-50 was promising for drought-prone rainfed uplands of Jharkhand after three years of testing.

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121 days. Most of the promising entries were above 113 cm.

The maximum yielding genotypes were CR 2722-151-2 (5.3 t / ha), CR 2716-10-IR 84898-B-165 (5.2 t / ha), CR 2715-13 (5.2 t / ha), CR 2724-72-1 (5.2 t / ha), CR 2720-2 (5 t ha), CR 2717-19 (4.9 t / ha), CR 2717-19 (4.9 t / ha) and CR-2717-10 (4.9 t / ha.

Observational yield trial under aerobic condition rabi *2010:* One hundred and sixty genotypes were evaluated during *rabi* 2010. The variation in yield ranged from 4.8 t / ha to 5.6 t / ha. The promising genotypes matured between 112 days to 120 days and produced more than 8 EBT. The promising five genotypes in ascending order of the yield were IR 84899-B-179-11-1 (4.8 t / ha), IR 84898-B-171-14-1 (4.88 t / ha), IR 84900-B-148-7-1 (4.9 t / ha), IR 84898-B-165-4-1 (5.1 t / ha) and IR 84898-B-170-11-1 (5.6 t / ha).

Development of Varieties for Different Seasons

Generation of breeding material: One hundred and thirty nine 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.

Development of Varieties for Unfavourable Shallow Lowlands

Variety Recommended for Release

CR Dhan 401 (IET 19969; CR 780-1937-1-3): Recommended for cultivation in shallow lowlands areas of Orissa and West Bengal in region 3, and in Tamil Nadu and Andhra Pradesh in region 5, the culture yields 5.4 t / ha in 150 days. It exhibited yield superiority over Savitri and regional check varieties particularly under late duration / shallow lowland conditions. It has medium slender grains with good grain quality traits. It is resistant to stem borer and LH and is moderately tolerant to GLH, WBPH, rice thrips and EHB.

Evaluation of Advance Breeding Lines in OYT (Station Trial)

Out of 60 entries, CR 2416-6-1-1-1-1 performed best with an average yield of 5.1 t / ha (DFF: 162) followed by CR 2415-43-1-1-1-1-1 (4.4 t / ha; DFF: 159 days) and CR 2416-15-2-2-7-1 (4.4 t / ha; DFF: 156) as against the best check Sarala (3.5 t / ha; DFF: 135 days).

Evaluation of Elite Breeding Lines in AYT (Station trial)

Twenty promising genotypes along with five check varieties were grown in a replicated trial under semi-deepwater logged situation during *kharif* 2010. Among the twenty entries CR 2416-13-1-1-1 gave the highest grain yield of 2.7 t / ha (DFF: 155 days) followed by CR 2439-B-12-1-1 (2.6 t / ha; DFF: 151 days) and CR 2416-6-1-1-1 (2.6 t / ha; DFF: 156 days) as against the best check Varshadhan (2.4 t / ha; DFF: 154 days).

Varietal Improvement for Rainfed Unfavourable Lowlands

Development of Suitable Varieties for Delayed Monsoon/Early Flooding

Eighteen advanced cultures were evaluated in replicated transplanted condition in *kharif* 2010 for yield and yield attributing characters with two check varieties Gayatri and Varshadhan with both normal and aged seedlings. CR 2389-5-2 (3.3 t / ha) gave a better yield than the best check Gayatri (3.2 t / ha) followed by CR 2304-5-7 (3.2 t / ha) and CR 2378-13-4 (3.2 t / ha). In case of delayed sowing, check variety Gayatri (3.3 t / ha) was the highest grain yielder followed by CR 2750-77-5 (3.2 t / ha) and CR 2753-6-8 (3.1 t / ha) that was superior to check Varshadhan (2.8 t / ha).

Based on the overall performance the cultures CR 2702-194, CR 2702-11-8 were nominated to AICRIP for IVT Late; CR 2702-18-56, CR 2702-62-6, CR-2458-72, CR-2573-621, CR 997-9-4 for IVT RSL and CR 2754-62-3, CR 2750-14-6, CR 2767-5-1 for evaluation in NSDWSN. CR 2459-12-8 was promoted to AVT 1 RSL, CR 2547-62-316 to AVT 1 semi-deepwater and CR 874-123-8, CR 758-16-6, CR 2565-549, CR 2550-77, CR 2543-83 to IVT SDW.

Salinity Breeding Network trial

Twentyfive entries received from the SBN pro-

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CR Dhan 401 (IET 19969; CR 780-1937-1-3) was recommended for cultivation in shallow lowlands areas of Orissa and West Bengal in region 3, and in Tamil Nadu and Andhra Pradesh in region 5.

gramme were grown in farmers' field at Kankan, in Ersama block of Odisha. The highest yield was obtained in CN 1266-3-2 (1.9 t / h; DFF: 104), followed by CR 2218-122-1-385-3-1 (1.7 t / h; DFF: 109) and CN 1266-9-6 (1.7 t / h; DFF: 99). Check Luna Suvarna yielded (1.6 t / h; DFF: 115).

Cultures Promoted in AICRIP Trial (NSASN to AL&ISVT)

Cultures promoted were: CR 2472-1-6-2-1 (IET 21736), 115 days, MS; CR 2485-7-3-45-1 (IET 21731), 120 days , LS; CR 2218-12-1-385-3-1 (IET 21726), 155 days, MB; CR 2213-5-3 (IET 21732), 150 days, MB; and CR 2462-1-154-1-1 (IET 21735), 145 days, MB.

Breeding for Floodprone Ecologies

Development of Varieties for Pre-Flood (*Ahu*), Post-Flood (*Sali*) and Flash Flood

Evaluation of varieties for pre-flood ahu *season:* During *ahu* 2010, 14 early maturing rice genotypes were evaluated for suitability as pre-flood *ahu* crop. Nilagiri yielded 5.19 t / ha with a DFF of 83 days followed by BAU 404-D2 (4.8 t / ha; DFF: 87), and Parijat (4.5 t / ha; DFF: 83). Check Luit yielded 4.2 t / ha (DFF 84).

Evaluation of varieties for post-flood situation: Ten genotypes consisting of early maturing photoperiod insensitive and photoperiod sensitive rice were evaluated for post flood *sali*. Genotype Kalong yielded 2.6 t / ha (DFF: 75) followed by Naveen (1.6 t / ha; DFF: 76)). All the others performed very poorly.

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CR Dhan 601 (IET 18558; CRG 1190-1) recommended for cultivation in *boro* areas of Orissa, West Bengal and Assam, yields 5.5 to 7.2 t/ha in 160 days.

Development of Varieties for *Boro*

CR Dhan 601 (IET 18558; CRG 1190-1): Recommended for cultivation in *boro* areas of Orissa, West Bengal and Assam, yields 5.5 to 7.2 t / ha in 160 days. It has medium slender grains with HRR of 72%. It is resistant to leaf blast and RTV and is moderately resistant to brown spot and sheath rot.

CR Boro Dhan 2 (IET 17612; CR 898): Resistant to leaf blast and BLB, CR Boro Dhan 2 was recommended for cultivation in *boro* areas of Orissa and Assam. It has medium slender grains with HRR of 66% and 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.

Hybrid Rice Technology

Hybrids Recommended for Release

IET 19600 (CRHR 5): The hybrid that was released as Rajalaxmi for irrigated areas of Orissa was superior to Gautam, IR 64, Krishna Hamsa and local in the *boro* areas. It has long slender grains with good quality, and yields 5 to 5.5 t / ha in 150 days. It was recommended for cultivation in *boro* in Assam and Orissa. CRHR 5 has tolerance to cold.

CR Dhan 701 (IET 20852; CRHR 32): This culture is the first long duration hybrid recommended for cultivation. It exhibited significant yield superiority over Savitri, Pooja and local, and was promising in shallow lowland conditions. It is resistant to leaf blast, and yields 4 to 6 t / ha in 145 days with medium-slender grains. It was recommended for cultivation in Bihar and Gujarat.

Transfer of Characters into CMS Lines

Hybrids were developed with donors for exserted stigma and resistance to BLB with CRMS 31B, CRMS 32 B and IR 42266-29-3R, to transfer these traits into the promising CMS and restorer backgrounds. BC_2F_3 and BC_2F_2 progenies of these crosses were grown and tested for presence of genes of interest. Some promising BC_2F_2

single plants with resistance genes and without fertility restorer genes were identified using molecular markers. Test crosses were initiated on the target CMS lines for identifying the maintainer reaction. BC_3F_1 hybrids were also produced with the recurrent parents, CRMS 31B and CRMS 32B on a few promising BC_2 plants with all three genes for BLB resistance but without the RF genes.

Backcrosses were continued with exserted stigma segregants by using as male parents on two CMS lines, CRMS 31A and CRMS 32A to transfer exserted stigma trait and develop improved CRMS 31A and CRMS32A. Crosses were also made with exserted stigma donor and a few more promising maintainer lines such as CRMS 8B, CRMS 45B and APMS 6B to transfer the trait into these lines to improve outcrossing.

Pyramiding of Rf genes into potential partial restorers for exploitation as restorers was taken up. BC_2 hybrids were developed with partial restorer recurrent parents, Mahalaxmi, Gayatri and PK 06-1 and were tested for presence of RF genes. Promising selections from BC_1F_3 were made and tested for presence of genes.

Production and Evaluation of Test Cross Hybrids

About 470 test cross hybrids involving seven CMS lines were evaluated in *rabi 20*10 and *kharif* 2010. Fortyfive fertile heterotic combinations (115-150 days duration) and 29 sterile F_1s were identified. The male parents (A-184-1-1(81), A-184-17-1(82), A-185-8-1(131), A-185-6-1(86) of some of the promising sterile F_1s had excellent outcrossing features with good floret opening and exserted stigma. These were of short duration with drought tolerance. Test crosses were also made with anther culture products from the crosses, CRMS31B x CRMS24B and CRMS32B x CRMS24B. A few sterile testcrosses were identified for backcrossing with the recurrent parents to develop long duration CMS lines.

The first long duration hybrid recommended for cultivation, CR Dhan 701 (IET 20852; CRHR 32) had significant yield superiority over Savitri, Pooja and the local, and was promising in shallow lowland conditions. It yields 4 to 6 t/ha in 145 days.

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Improvement of Grain and Nutritional Quality

Breeding for Quality Rice

CRRI Aromatic Cultures in AICRIP Trials

CR 2616 (IET 21044) was promoted to fourth year of testing on the basis of overall performance and quality.

CR 2613 (IET-21271) was promoted to third year of evaluation.

CR 2713 (IET 21840) and CR 2711 (IET 21833) with superior yield performance over checks were promoted to second year of testing.

Evaluation

Forty promising aromatic, semi-dwarf, high-yielding breeding lines with medium slender grain developed from Swarna / Geetanjali (CR 2713), Geetanjali / Dubraj (CR 2934), CRM 2203-4 / Dubraj (CR 2947), Padmini / KDML 105 (CR 2711) and CRM 2203-2 / Dubraj (CR 2945) were evaluated under AYT. CR 2947-18 yielded 4.4 t / ha (DFF: 130), CR 2713-180 (3.8 t / ha; DFF: 117), CR 2947-14 (3.8 t / ha; DFF: 125). Check Badshabhog gave 1.8 t / ha (DFF: 128) and Kalanamak 1.2 t / ha (DFF: 121).

Development of High-yielding Varieties for Grain Quality, Organic and Nutritional Enrichment

Quality rice with slender grain: In AYT 24 promising slender grain selections belonging to four crosses (IR 64 Pusa 44, BPT 5204 and Swarna with Banskathi) were evaluated along with checks Swarna, Gayatri and Pooja. The top five cultures were CR 2942-116 (5.5 t / ha), CR 2942-68 (5.4 t / ha), CR 2942-120 (5.3 t / ha), CR 2942-112 (5 t / ha) and CR 2942-159 (5 t / ha). Checks Swarna yielded 5.3 t / ha, Gayatri 5.5 t / ha and Pooja 6.1 t / ha.

Breeding for High Protein Rice

CR 2819-1-3 (12.08% CP), CR 2821-1-8 (11.9% CP), CR 2820-1-8 (11.8% CP) were identified as high protein F_3 population along with high protein donor, ARC 10075-6 (11.75% CP).

CR2821-1-5 (10% CP), CR2821-1-9 (10.8% CP) and CR2821-1-3 (10.0% CP) showed higher protein yield of 68 g / m^2, 46 g / m^2 and 34 g / m^2, respectively than Naveen (30 g / m^2), Swarna (31 g / sq m) and IR 64 (24.1 g / sq. m).

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

Identification of New Sources of Resistance/tolerance and Mechanism of Resistance/tolerance to Major Diseases

Blast

Two thousand two hundred and sixtysix germplasm collections comprising of NSN 1 (171), NSN 2 (579), NHSN (94), NSN H (79), DSN (106), Virulence Monitoring Set (VMS) (25), CRRI collection including HYV (550), drought breeding lines for unfavourable lowland (66), aerobic AYT (33), aerobic OYT (234), DRR collections (329) were screened against blast disease in the UBN during *rabi* and *kharif* 2010. One hundred abd seventytwo resistant lines were identified showing disease score of 0-1 in the SES scales. The susceptible checks HR 12 and B40 had scores of 9 and location severity index > 5.

Bacterial Blight

One thousand seven hundred and sixteen germplasm collections comprising of NSN 1 (171), NSN 2 (579), NHSN (94), NSN H (79), DSN (106), virulence monitoring set (25), drought breeding lines (66), aerobic AYT (33), aerobic OYT (234) and germplasm collections from DRR (329) were screened against BLB in the field during k*harif* 2010. Thirtyeight resistant lines were identified showing disease score of 0-1 in the SES scales. The susceptible checks TN 1 and Tapaswini had score of 9 and location severity index > 5.8.

Sheath Blight

One thousand six hundred and ninetyone germplasm collections comprising of NSN 1 (171), NSN 2 (579), NHSN (94), NSN H (79), DSN (106), drought breeding lines (66), Aerobic AYT (33), Aerobic OYT (234) and germplasm collections from DRR (329) were screened against sheath blight disease under artificial inoculation in the field in *kharif* 2010. All the entries were found susceptible showing score of 5 to 9 in the SES scale and disease severity index > 6.

Rice Tungro Virus

One thousand and fortyseven germplasm collections consisting of NSN 1 (171), NSN 2 (579), NHSN (94), NSN-H (79) and DSN (106) were screened against RTV under field conditions. Eighteen tolerant lines were identified, with score 3 in the SES scale and location severity index > 6.2.

Performance of Resistant Cultures in AICRIP PHS Trial

Entries CR 2711-76 (Tapaswini x Dhobanumberi), CR 2711-114 (Tapaswini x Dhobanumberi), CR 2711-139 (Tapaswini x Dhobanumberi), CR 2711-149 (Tapaswini x Dhobanumberi) and CR 2712-12 (Samba Mahsuri x Salkathi), which were promising in the AICRIP PHS trial in the first year of testing were evaluated for the second year in the AICRIP PHS trial at 18 locations across the country against BPH, WBPH, GLH and mixed populations of planthoppers under both field and greenhouse tests. All the five entries were again found to be promising.

Breeding for Resistance to Rice Tungro Disease

IET 21589 (CR 2649-7): Derived from Udaya and tungro resistant donor IET 16611, yielded 5 t / ha in 98 days over 36 locations in AVT 1-IME trial of AICRIP 2010. In region 3 it exhibited yield advantage of 5.2% over the best check and yield superiority over the best check at Jharkhand (14.7%), Tripura (16.2%) and Tamil Nadu (14.2%). It has short bold grains with 62.2% HRR, intermediate ASV of 4, and AC of 24.48%. This culture has been promoted to AVT 2-IME.

IET 21346 (CR 2652-14): Derived from Sarala and tungro resistant donor CR 682- 165-1 yielded 2.4 t / ha in 118 days across nine locations in IVT-SDW trial of AICRIP, 2010. It also showed yield superiority of 37.8% over the best check in region 5 and ranked first at Sirsi (2.3 t / ha) with significant superiority over national, regional and local checks. It had good submergence tolerance, elongation ability and phenotypic acceptability. It has been promoted to AVT 1-SDW.

IET 22117 (CR 2644-2-6-4-3-2): Developed from Tapaswini and tungro resistant donor IET 16611 it was promoted to AVT-1-IME based on its overall performance.
IET 21890 (CR 2653-16-5-3-4-2): Developed from cross of Pooja and tungro resistant donor IET 16952 was promoted to IVT- SDW from NSDWSN trial of AICRIP 2010.

Three cultures IET 21865 (CR 2654-17-3-2-2), IET 21879 (CR 2482-5-2-3-2) and IET 21709 (CR 2482-10-4-3-2) were resistant to RTV with low susceptibility index of 3 at CRRI, DRR and Tirur in NSN 2 trial of AICRIP, 2010.

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In the uniform blast nursery, 2,266 germplasm were screened for blast.

Enhancing and Sustaining the Productivity of Rice-based Farming Systems

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

Yield and N uptake of rice Gayatri under eight different treatments were studied. Application of nitrogen gave significantly higher grain yields over no N control. Substitution of chemical N (25%) with crop residue to provide 60 kg N / ha gave comparable grain and straw yields as that of chemical N. Superimposition of 60 kg chemical N / ha (urea) on 2.5 t / ha crop residue increased the grain and straw yield of rice over sole application of urea. Crop residues generally take longer time to decompose and immobilize a part of applied N. But superimposition of crop residue (rice straw) up to 5 t / ha on normal dose of fertilizer gave comparable yield up to 60 kg N / ha when the soil organic N (0.063%) and organic carbon status (0.76%) were comparatively high (Table 2). N uptake in grain was maximum when 5 t / ha of rice straw + 30 kg N / ha (Dhaincha) were applied. The N uptake by grain was at par with 2.5 t / ha rice straw + 60 kg N / ha (urea), 2.5 t / ha rice straw + 45 kg N / ha (Dhaincha) and 5 t / ha rice straw + 60 kg N / ha (urea) treatments. But it was significantly higher than the control. Substitution of chemical N (50%) with crop residue to provide 60 kg N / ha gave comparable N uptake as that of chemical N.

Different soil organic carbon fractions were measured after harvest of the crop. Microbial biomass carbon (MBC) was significantly higher in 5 t / ha rice straw + 30 kg N / ha (urea) treatment than in the control and other treatments. Readily mineralizable C was significantly higher (188.8 µg / g) in 5 t / ha rice straw + 60 kg N / ha (urea) and 5 t / ha rice straw + 30 kg N / ha (urea) treatments than the control (Table 3). Whereas, oxidizable organic C was higher where 5 t / ha was applied along with urea and dhaincha. Soil enzymatic activities were studied after harvest of the crop. Dehydroge-

Table 2. Grain and straw yield of rice Gayatri grown in *kharif* 2010.

Treatment	Grain yield (t / ha)	Straw yield (t / ha)
Control	4.07 ^{a}	3.61 ^{a}
Urea 60 Kg N / ha in 3 splits (50 + 25 + 25)	5.30 ^{bc}	5.33 ^{b}
2.5 t / ha rice straw+45 kg N / ha (urea) in splits	4.80 ^{ab}	5.54 ^{bc}
2.5 t / ha rice straw + 60 kg N / ha (urea) in splits	5.93 ^{c}	6.09 ^{bcd}
2.5 t / ha rice straw+ 45 kg N / ha (Dhaincha)	5.60 ^{bc}	6.60 ^{cd}
5 t / ha rice straw+30 kg N / ha (urea) in split	5.13 ^{bc}	5.59 ^{bc}
5 t / ha rice straw+ 60 kg N / ha (urea) in split	5.47 ^{bc}	6.05 ^{bcd}
5 t / ha rice straw+ 30 kg N / ha (Dhaincha)	5.57 ^{bc}	6.89 ^{d}
C.D. (5%)	0.86	1.09

Table 3. Soil carbon fractions under different treatments after harvest of the crop.

Treatments	MBC (µg / g)	RMC (µg / g)	O.C (g / kg)
Control	192.7 ± 28[a]	37.8 ± 6.5[a]	3.8 ± 0.1[a]
Urea 60 kg N / ha in 3 splits	317 ± 26.3[bc]	86.8 ± 6.5[b]	4.9 ± 0.1[c]
2.5 t / ha rice straw+45 kg N / ha (urea) in splits	272.5 ± 12.8[b]	117 ± 13.1[c]	4.5 ± 0.1[b]
2.5 t / ha rice straw + 60 kg N / ha (urea) in splits	377.1 ± 25.7[de]	120.8 ± 17.3[c]	4.2 ± 0.2[b]
2.5 t / ha rice straw+ 45 kg N / ha (Dhaincha)	285.2 ± 33.3[b]	105.7 ± 23.6[bc]	4.9 ± 0.2[c]
5 t / ha rice straw + 30 kg N / ha (urea) in split	416.9 ± 23[e]	147.2 ± 11.3[d]	5.4 ± 0.1[d]
5 t / ha rice straw+ 60 kg N / ha (urea) in split	345.8 ± 15.7[cd]	188.8 ± 6.5[e]	5.1 ± 0.1[c]
5 t / ha rice straw+ 30 kg N / ha (Dhaincha)	337.8 ± 24.7[cd]	188.8 ± 17.3[e]5 ± 0.5[c]	
CD (5%)	45.17	26.01	0.37

nase activities, fluorescein diacetate assay and α-glucosidase activities were significantly higher in 5 t / ha rice straw + 30 kg N / ha (urea) treatment than in the control and other treatments. However, the total microbial activities (FDA) was at par in 5 t / ha rice straw + 30 kg N / ha (urea) and 5 t / ha rice straw + 60 kg N / ha (urea) treatments. Whereas, acid and alkaline phosphatase activities were significantly higher when 60 kg N / ha (urea) was superimposed with 5 t / ha rice straw.

Developing IPM Technologies for Different Rice Ecologies

Studies on Components of IPM

Long-term Pesticide Trial

Cartap @ 1 kg ai / ha, Chlorpyriphos @ 0.5 kg ai / ha, Carbendazim @ 1%, and Pretilachor @ 0.75 kg ai / ha were applied in the field with rice Naveen during *rabi* and *kharif* 2010. In *rabi* application of Cartap had the least incidence of DH 4.57%, WEH 4.45%, gundhi bug 11.19%, and Naveen yielded 4.4 t / ha. In the control the damage was DH 8.47%, WEH 8.25% and gundhi bug 13.52%. Among the natural enemies the population of spider was at par (6.5–7 spiders / sweep) in all the treatments except with Pretilachlor (4.5 spiders / sweep). At 60 DAT the weeds were *Commelina benghalensis*, *Monochoria vaginalis*, *Ipomoea aquatic*, *Marsilea quadrifoliata*, *Trianthema portulacastrum*, and *Sagittaria sagitifolia*.

During *kharif*, application with Cartap resulted in the lowest incidence of DH 4.72%, WEH 4.6% and gundhi bug 20.1%. In Naveen the highest grain yield was 4 t / ha. In the control the damage was DH 9.1%, WEH 8.95%, and gundhi bug 27.18%, The yield was 2.9 t / ha. The important weeds @ 30 DAT were *Echinochloa* spp., *Cyperus iria*, *Fimbristylis miliavea*, *Sphenochea zeylanica* and *Ludwigia parviflora*. Application of Cartap reduced the population of rice root nematode in the soil by 66.3% and by 69% by Chlorpyriphos. Application of Pretilachlor and Carbendazim did not have any significant effect on its population.

Grossly no trend was observed between *rabi* and *kharif* results , but population of some microbes declined in *kharif*. Generally inhibitory effect was more for cartap and no general trend for other pesticides could be obtained.

Testing of New Insecticide Molecules against Insect Pests of Rice

Eight formulations of insecticides (Flubendiamide 4% + Buprofezin 20%) @ 875 ml / ha, Flubendiamide 20% @ 175 ml / ha, Buprofezin 25% @ 700 ml / ha, Acephate 95% SG @ 592 ml / ha, Dinotefuron 20% @ 200 ml / ha, Dinotefuron 20% @ 150 ml / ha, Acephate 75 SP @ 800 ml / ha, with Monocrotophos 36% @ 1,390 ml / ha were screened against insect pest of rice during *rabi* and *kharif* 2010 with rice Jaya. The results in *rabi* revealed that application of Flubendiamide + Buprofezin gave the lowest incidence of DH (3.73%), WEH (3.23%), gundhi bug (10.26%) and the highest yield of 4.5 t / ha in rice Jaya. All the insecticides were effective against YSB. In the control, YSB was 9.23% DH, 9.23% WEH, gundhi bug 21.16% and the grain yield 3.38 t / ha.

In *kharif* Flubendiamide + Buprofezin the damage was DH 3.46%, WEH 3.46%, gundhi bug 11.93% and highest grain yield of 5.8 t / ha in variety Jaya. All the insecticides were effective against YSB. In the control, damage due to YSB was 8.83% DH, 9.03% WEH, gundhi bug 32.56%, and the grain yield was 3.4 t / ha.

Botanicals Grain Protectants and Pheromones against Rice Storage Insects

Dried fruit powder of black pepper, *Piper nigrum* L. was found as an effective grain protectant @ 2 g / kg milled rice against saw toothed grain beetle, *Oryzaephilus surinamensis* Linn., when tested under artificial infestation stored in poly-bags for 180 days.

Dried leaves of lotus, *Nelumbo nucifera* Gaertn. @ 1% w / w completely inhibited the population build-up of angoumois grain moth, *Sitotroga cerealella* under artificial infestation on variety Ratna for 50 days.

IPM Module for Upland Rice

A field trial for insect pest management in upland rice with Brown Gora and Anjali during *kharif* 2010 was conducted at village Banipada, Tangi-Chaudwar block, Cuttack. Under IPM practices seeds were treated with Chlorpyriphos @ 3.75 l / 100 kg seed. Herbicide Pretilachlor was applied @ 0.75 kg ai / ha three DAS.

Table 4. Effect of IPM on insect pests of rain fed upland rice during *kharif* 2010, Cuttack.

Treatments	DH (%)	WEH (%)	Gundhi bug (%)	Yield (t/ha)
Anjali IPM	3.38 (10.58)	3.54 (10.83)	9.02 (17.46)	2.65
Anjali non-IPM	7.25 (15.63)	7.36 (15.73)	15.4 (23.08)	1.47
Brown Gora IPM	4.22 (11.83)	4.42 (12.11)	10.4 (18.8)	2.18
Brown Gora non-IPM	8 (16.42)	8.22 (16.65)	7.16 (24.45)	1.13
CD 5% for variety	0.62	0.5	0.78	0.17
CD 5% for treatment	0.98	0.8	1.24	0.27

Data in the parentheses are angular transformed values.

Table 5. Economics of IPM practice in rainfed upland rice at Cuttack, *kharif* 2010.

Treatment	Additional returns (₹)	Additional cost (₹)	IB : C
Anjali IPM versus non-IPM	11,976	7,064	1.7
Brown Gora IPM versus non-IPM	11,824	7,064	1.67
Anjali IPM versus Brown Gora non-IPM	15,316	7,214	2.12

Monocrotophos (0.5 kg ai/ha) at maximum pest infestation, pheromone traps and trichocards for the management of YSB were followed in IPM plots. The highest grain yield of 2.65 t/ha with least incidence of DH (3.38%), WEH (3.64%) and gundhi bug (9.02%) were recorded in Anjali under IPM practice (Table). This treatment was better than that of farmer practice/non-IPM in reducing the insect damage and increasing the grain yield in both the varieties. The highest increased benefit : cost ratio (2.12) was in Anjali under IPM practice.

Socio-Economic Research for Sustainable Development

Impact Analysis and Adoption Strategies for Various Ecosystems

Extent of Adoption of Rice Production Technology and their Appropriateness and Constraints as Perceived by Growers

The study was undertaken in Khandaita cluster of Cuttack Sadar block of Cuttack district. The major land type of this area was shallow to semi-deep lowlands. The study comprised of 100 rice farmers selected by random sampling. The results are in Table 6 to 11.

Table 6. Extent of adoption of CRRI rice varieties by the farmers Khandaita cluster of Cuttack Sadar block of Cuttack district.

Variety	Farmers adopted under different categories				Total land holdings (ha)	Cultivated land (ha)	Extent of adoption in terms of area	Total adoption (%)
	Small (n 58)	Medium (n 30)	Large (n 12)	Total (n 100)				
Gayatri	49 (84.48)	28 (93.33)	11 (91.67)	88 (88)	72	35.3	48.64%	99.93
Pooja	47 (81.03)	26 (86.67)	10 (83.33)	83 (83)	72	25.52	35.1%	
Varshadhan	10 (17.24)	10 (33.33)	5 (41.66)	25 (25)	72	6.1	8.46%	
Sarala	10 (17.24)	9 (30)	6 (50)	25 (25)	72	5.6	7.73%	

Table 7. Appropriateness of CRRI rice varieties as perceived by the rice growers (n 100).

Appropriateness	CRRI rice varieties			
	Gayatri	Pooja	Varshadhan	Sarala
Social appropriateness	2.25	2.25	2.25	1.5
Economic appropriateness	3	2.75	2.5	1.5
Environmental appropriateness	3	2.75	2.33	1.33
Technological appropriateness	3	2.8	2.4	2.4
Total	2.81	2.63	2.37	1.68

Table 8. Appropriateness of CRRI rice variety Gayatri as perceived by the farmers adopted under different categories.

Appropriateness	Farmers adopted under different categories			
	Small (n 58)	Medium (n 30)	Large (n 12)	Total (n 100)
Very Appropriate (score more than 2.4)	51 (87.9)	27 (90)	11 (91.67)	89 (89)
Somewhat Appropriate (score 1.8-2.4)	7 (12.1)	3 (10)	1 (8.33)	11 (11)
Less appropriate (score less than 1.8)	0 (0)	0 (0)	0 (0)	0 (0)

Table 9. Appropriateness of CRRI rice variety Pooja as perceived by the farmers adopted under different categories.

	Farmers adopted under different categories			
Appropriateness	Small (n 58)	Medium (n 30)	Large (n 12)	Total (n 100)
Very appropriate (score more than 2.4)	48 (82.76)	27 (90)	10 (83.33)	85 (85)
Somewhat appropriate (score 1.8-2.4)	10 (17.24)	3 (10)	2 (16.67)	15 (15)
Less appropriate (score less than 1.8)	0 (0)	0 (0)	0 (0)	0 (0)

Table 10. Appropriateness of CRRI rice variety Varshadhan as perceived by the farmers adopted under different categories.

	Farmers adopted under different categories			
Appropriateness	Small (n 58)	Medium (n 30)	Large (n 12)	Total (n 100)
Very appropriate (score more than 2.4)	12 (20.69)	11 (36.67)	5 (41.67)	28 (28)
Somewhat appropriate (score 1.8-2.4)	39 (67.24)	16 (53.33)	7 (58.33)	62 (62)
Less appropriate (score less than 1.8)	7 (12.07)	3 (10)	0 (0)	10 (10)

Table 11. Appropriateness of CRRI rice variety Sarala as perceived by the farmers adopted under different categories.

	Farmers adopted under different categories			
Appropriateness	Small (n 58)	Medium (n 30)	Large (n 12)	Total (n 100)
Very appropriate (score more than 2.4)	9 (15.52)	7 (23.33)	2 (16.67)	19 (19)
Somewhat appropriate (score 1.8-2.4)	23 (39.66)	6 (20)	4 (33.33)	32 (32)
Less appropriate (score less than 1.8)	26 (44.82)	17 (56.67)	6 (50)	49 (49)

Rice Gayatri was 'very appropriate' (score more than 2.4) as perceived by majority of farmers (89%).

Krishi Vigyan Kendras

Santhapur

Training

Training was conducted for 1,210 farmers/farmwomen in "Vermi-composting," "Safe storage of rice grains and seeds," "Safe storage of rice grains and seeds," "Soil sampling techniques and importance in crop production," "Establishment of new orchards," "Vermi composting as self employment tool," "Preventive measure of dairy animals before rainy season," "Nursery raising of paddy by scientific methods," "IPM in field crops," "Scientific method of sheep and goat rearing," "IPM in horticultural crops," "Other than poultry rearing in backyard system," "Crop diversification," "Nursery raising of vegetables by scientific methods," "Integrated farming system—fish with livestock," "IDM in field crops," "Mushroom production for nutritional security," "Integrated weed management in paddy," "Mushroom production for nutritional security," "Nursery raising of vegetables by scientific methods," "Organic farming," "Contagious disease and its prevention in animals and birds," "Care and management of backyard poultry rearing in extensive system," "Mushroom cultivation," "Leadership development," "INM in field crops," "Nursery raising of cauliflower and cabbage," "Crop diversification," "Management of nutritional garden," "Mushroom production for nutritional security," "Integrated farming (livestock + fish)," "Biological control of crop pest," "Biological control of crop diseases," "Clean milk production," "Pisciculture," "Crop diversification," "Formation and management of Farmers' Club," "Leadership Development" and "Formation and management Self-help Group."

In-service training to 50 participants was given on "Organic Farming" and "Use of bio-fertilizer in horticultural crops."

Four sponsored training programmes were given to 100 participants on "Dairy management" with VAS, Tangi, "Vermicomposting and its use in horticultural crops," and "Sorting and grading of vegetables," with the Horticulturist, Cuttack, and "Mushroom for entrepreneurship development," with the Nehru Yuva Sangathan, Cuttack.

Koderma

Training

Training programmes were conducted on "Upgradation of desi milch cow," "Vaccination schedule of cattle," "Control of ecto and endo parasite infestation in goat," "IPM in okra," "Package and practices of Ber," "Bal and aonla cultivation," "Improved package and practices of *kharif* season vegetables," "Lac cultivation," "Quality test of rice (Sahabhagi and Sita)," "Conduction of OFT in farmers field," "Techniques of seed treatment in rice," "Making different types of papad and chips," "Lac cultivation," "Improved package and practices of *kharif* season onion cultivation," "Cultivation of papaya," "Nursery management of chicks," "Improved paddy cultivation for different farming situation," "Resource conservation technologies in rice," "Techniques of seed treatment in *kharif* pulses," "Seed treatment in rice crop," "Care and management of duck," "Prevention of Ranikhet disease in poultry," "Care and management of poultry," "Seed production techniques in rice," "Seed production techniques in rice," "Value added food production cereals and pulses," "Improved balanced diet for adolescent girls," "Protective vegetable cultivation," "Early sowing vegetable cultivation of *rabi*," "Control of ectoparasite in cattle," "INM in rice," "Early sowing vegetable cultivation of rabi," "Nutritional kitchen garden," "Orientation training for women and child care," "Control of mange infection in calf," "Pond for fish farming," "Scientific method for preservation of seasonal fruit," "Formation of self help group," "Integrated pest management,"" Gardner training (orchard & agro-forestry)," "Vaccination of backyard poultry," "Care and management of backyard poultry," "Commercial broiler farm," "Improved feeding practice in farm Animal, ICM

KVK, Koderma

Various training programmes were organised by the KVK, Koderma for farmers.

in mustard crop, Preparation of vermi compost, vermi wash and its use," "Resource conservation technology," "Value addition of tomato," "Characterization of existing SHG for training needs," "IPM in vegetable crop," "Improved method of nursery raising of different crop," "Control of ticks population in cattle," "Control of Ranikhet disease in poultry," "Cultivation of oyster mushroom in local condition," "Balanced fertilization in potato cultivation," "Identification and management of insect pest and disease of potato," "Zero-tillage cultivation of wheat," "Care and management of kids," "Computation of balanced ration from local available ingredients," "Storage of food grain in local condition," "Scientific oyster mushroom cultivation," "Cultivation practice of Marigold for commercial purpose," "Care and management milch cow in winter," "Drudgery reduction in farm operation for farmwomen," "Preservation of mixed vegetable pickle," "Rainfed agriculture technique," "Care and management of newly born calf," "ICM in wheat," "Care and management milch cow in winter," "Gardening training (Orchard and Agroforestry)," "Improved cultivation of Rose," "Marigold and Gladiolus for commercial cultivation," "IPM in onion and garlic," "Care and management of cross breed heifer," "Cultivation of medicinal plants," "Improved package and practice of hybrid tomato cultivation," "Value added food product of Ragi," "Awareness about nutrition garden," "Control of PPR in goat," "IPM in cucurbits," "Introduction of toria / mustard crop followed by upland rice," "Importance of soil testing and method of soil sampling," "Nursery rising of vegetable and fruit crops," "Create awareness about breed improvement" and "Improved package and practices of *kharif* seasons onion cultivation."

Publications

Research Papers

Das, S., Bhattacharyya, P., and Adhya, T.K., 2011. Impact of elevated CO_2, flooding and temperature interaction on heterotrophic nitrogen fixation in tropical rice soils. *Biol Fertil Soils*. 47: 25-30.

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Mahata, K.R., Singh, D.P., Saha, Sanjoy, Ismail, A.M. and Haefele, S.M. 2010. Improving rice productivity in the coastal saline soils of the Mahanadi delta of India through integrated nutrient management. Editors C.T. Hoanah *et.al.* in *Tropical Deltas and Coastal Zones: Food Production, Communities and Environment at the Land-water Interface*. CAB International, 239-248.

Nayak, J. and Mallick, P.K., 2010. Empowerment of farm women through dairy cooperative. *Indian Journal of Dairy Sciences* 63(2): 114-117.

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Rath, P.C., and Marandi, B.C., 2010. Evaluation of resistance in some rice germplasm against white backed plant hopper, *Sogatella furcifera*. *Indian journal of Plant Protection*, 38(2): 197-199.

Saha, Sanjoy and Rao, K.S., 2010. Efficacy of metsulfuron methyl for controlling broadleaf weeds in transplanted rice (*Oryza sativa*) under rainfed shallow lowland. *Indian J. Agric. Sci.* 80(6): 522-526.

Saha, Sanjoy and Rao, K.S., 2010. Evaluation of bensulfuron-methyl for weed control in wet direct-sown summer rice. *Oryza* 47(1): 38-41.

Singh, D.P., Mahata, K.R., Saha, Sanjoy and Ismail, A.M., 2010. Crop diversification for improving water productivity and rural livelihoods in coastal saline soils of the Mahanadi delta, India. In: Editors C.T. Hoanah *et.al., Tropical Deltas and Coastal Zones: Food Production, Communities and Environment at the Land-water Interface*. CAB International, 249-263.

RAC, IMC, IJSC, IRC and SAC Meetings

Research Advisory Committee

The XVI Meeting of the Research Advisory Committee (RAC) was held at Central Rice Research Institute from 6 to 7 Sep 2010. The following members were present:

Dr R.K. Singh ..... Chairman
Dr B.Vidyachandra ..... Member
Dr S.K.Sharma ..... Member
Dr T.K.Adhya ..... Member
Dr R.P. Dua ADG (FFC), ICAR, ... Member
Shri Digambar Mohapatra,
Representative of Agril. /
Rural Interest ..... Member
Dr S.S. Rahangdale, Representative of
Agril. / Rural Interest ..... Member
Dr R.N. Rao ..... Member Secretary

Dr B.C. Viraktamath, Director, DRR, Hyderabad attended the meeting as a special invitee of the Chairman.

Drs A.P.K. Reddy and Karabi Dutta, Members, RAC could not participate in the meeting due to preoccupation.

The Chairman, along with all the RAC members, conducted a pre-meeting briefing that was followed by an open session that included presentation of the research progress.

Institute Management Committee

Budgetary provisions and purchase and approval of equipments were the major issues of discussion in the 21st Institute Management Committee (IMC) meeting of the CRRI held on 26 Apr 2010 at Cuttack. Dr T.K. Adhya, Director, CRRI chaired the meeting. Also present were Drs Anand Prakash, K.S. Rao, M.M. Panda, Vishal Nath, J.K. Jena, Shri G.P. Tripathy, Shri Digambar Mohapatra, and Shri S.K. Sinha.

The 22nd Institute Management Committee meeting of the CRRI was held on 22 Jan 2011 at Cuttack under the chairmanship of Dr T.K. Adhya, Director, CRRI. The Members present were Drs S. Gopalan, IAS, Director of Agriculture and Food Production, Government of Orissa, K.S. Rao, Principal Scientist and Head, Division of Crop Production, Anand Prakash, Principal Scientist and Head, Division of Crop Protection, and Shri Digambar Mohapatra. Shri D. Moitra, CAO, CRRI was the Member-Secretary.

Institute Joint Staff Council

Dr T.K. Adhya, Director, CRRI chaired the meeting of the IJSC at CRRI, Cuttack on 22 Apr 2010. The meeting reviewed various administrative issues, staff welfare measures and infrastructural requirements in the campus. The Members present were Dr Mayabini Jena,

Seen in the photograph are the Members of the RAC during the XVI meeting.

B. Behera

B. Behera

Members deliberate during the 21st IMC meeting on 26 Apr 2010.

P.N. Mishra, Shri S.K. Sinha, Shri D. Sahoo, Shri B.K. Sahoo, Shri D.K. Parida, Shri S.B. Nayak, Shri N. Bhattacharya, Shri P. Moharana, Shri K.C. Bhoi, Shri B.B. Das, Shri B.K. Behera and Shri P. Bhoi. Dr K.S. Rao could not attend the meeting.

The 2nd IJSC (2009–12) was held on 10 Aug 2010. It was chaired by Dr T.K. Adhya, Director. The members who attended the meeting were Drs Mayabini Jena and P.N. Mishra, Shri S.K. Sinha, Shri D. Sahoo, Shri B.K. Sahoo, Shri D.K. Parida, Shri S.B. Nayak, Shri N. Bhattacharya, Shri P. Moharana, Shri K.C. Bhoi, Shri B.B. Das, Shri B.K. Behera and Shri P. Bhoi.

Institute Research Council

Field Visit

Dr T.K. Adhya, Director and Chairman, IRC and Members of the IRC visited the field trials and net houses of the projects under all programmes from 12 to 15 Apr 2010 and on 22, 25 and 26 Oct 2010.

The 26th Meeting of the IRC was held from 14 to 25 May 2010 under the Chairmanship of Dr T.K. Adhya.

The 27th Meeting of the IRC was held from 10 to 14 Jan 2011 under the Chairmanship of Dr T.K. Adhya. Dr Swapan K. Datta, Deputy Director-General (Crop Sciences) presided over the inaugural session.

Scientific Advisory Committee of Krishi Vigyan Kendra

Santhapur

The 12th Scientific Advisory Committee meeting of the Krishi Vigyan Kendra, Santhapur, Cuttack was held on 8 Mar 2011 in its campus under the Chairmanship of Dr T.K. Adhya, Director, CRRI. The Members who participated were: Dr S.S. Nanda, Dean, Extension Education, OUAT, Bhubaneswar; Shri B.N. Behera, Dy. Director of Agriculture, Cuttack; Dr R.C. Behera CDVO, Cuttack; Dr H.S. Singh, Head, Central Horticultural Experiment Station, Bhubaneswar; Dr Dayamoy Mondal, Head, CARI Regional Centre, Bhubaneswar; Dr Urbasi Behera, Dy. Director of Fisheries, Cuttack Range, Cuttack; Er. Subrat Das, Asstt. Engg. Irrigation, Mahanadi South Division, Cuttack; Shri P.C. Swain, AHO, DDH, Cuttack; Shri Brajabandhu Panigrahi, Soil Conservation Officer, Cuttack; Shri Durga Majhi, Farm Radio Officer, Cuttack; Smt P. Ojha, Lady Farmer representative; Shri Ashok Kumar Samal, Farmers representative and Shri B.R. Praharaj, Farmers representative. Dr S.M. Prasad, Senior Scientist and OIC, KVK, Santhapur was the Member-Secretary.

Foreign Deputation

Dr A. Ghosh visited the IRRI, Philippines as a visitor / collaborator to the Plant Breeding, Genetics and Biotechnology (PBGB) Division from 19 Apr to 8 May 2010 under the ADB / IRRI supported collaborative project "Development and Dissemination of Water-saving Rice Technologies in South Asia."

Drs T.K. Adhya, D.P. Singh and M. Variar attended the 9th CURE Review and Steering Committee Meeting at Siem Reap, Cambodia during 3 to 6 May 2010. Shri R.K. Sahu attended a training workshop on "Quality Rice Seed Production" at the Bangladesh Rice Research Institute (BRRI), Gazipur, Bangladesh from 9 to 15 May 2010.

Shri S.K. Sinha, Senior Administrative Officer attended a training programme at the Cornell University, Ithaca, USA from 4 to 15 Oct 2010.

Drs O.N. Singh, J.N. Reddy, M. Variar, N.P. Mandal, C.V. Singh, Sanjukta Das and Bijoya Bhattacharjee participated in the 3rd International Rice Congress at Hanoi, Vietnam from 8 to 12 Nov 2010.

Dr T.K. Adhya attended UNEP Scoping Meeting "Promoting Sustainable Agri-food Systems: High Stakes and the way Forward" at Environment House, Geneva, Switzerland from 11-12 Nov 2010.

Drs D.P. Singh and R.K. Sarkar attended the International Conference Delta 2011 on "Deltas under Climate Change: Challenges of Adaption" at Hanoi, Vietnam from 2-4 Mar 2011.

Dr T.K. Adhya attended the Expert Workshop on "Ramshar Convention Contracting Parties Relating to Rice and Biodiversity" organized by ATSIP of James Cook University at Singapore from 3-4 Mar 2011.

Dr T.K. Adhya attended the workshop on "International Soil Carbon Monitoring Standards and Methodologies" organized by BBSRC, United Kingdom, from 21-24 Mar 2011 at London, United Kingdom.

Seen in the photograph are the delegates at
the 9th CURE Review and Steering Committee Meeting at Siem Reap, Cambodia.

Courtesy: IRRI, Philippines

Farmers' Day, Workshops and Seminars Organized

B. Behera

Dr Damodar Rout hands over a certificate to a progressive farmer during the CRRI Foundation Day celebrations.

CRRI Foundation Day Celebrated

Dr Damodar Rout, Hon'ble Minister of Agriculture, Department of Co-operation, Fishery and Animal Husbandry , Government of Orissa inaugurated the 64th Foundation Day the CRRI in Cuttack on 23 April 2010. Progressive farmers who adopted innovative rice farming practices were felicitated by the Hon'ble Minister.

Women in Agriculture Day Celebrated

The CRRI KVK, Santhapur, Cuttack celebrated the "Women in Agriculture Day," on 4 Dec 2010 on the theme "Technologies for Farm Women in Homestead Enterprises." Two hundred farmwomen participated in the programme.

Hindi Fortnight Observed

The Hindi Fortnight was observed from 14 to 29 Sep 2010 at the CRRI, Cuttack. Dr A.K. Patnaik, Former Head of Department of Hindi, Ravenshaw University, Cuttack distributed the certificates. Shri J.P. Gupta, Ex-Honorary Professor (English), Bhadrak College, Bhadrak and Shri Vimal Mishra, Senior Hindi Teacher, Hindi Teaching Scheme, Cuttack, also participated.

Vigilance Awareness Period

The Vigilance Awareness Period was held from 25 Oct to 1 Nov 2010. Dr T.K. Adhya, Director administered the pledge. Shri D. Moitra, Chief Administrative Officer read out a message from the Central Vigilance Commissioner, Government of India. Shri Manmohan Praharaj, IPS, Director General of Police, Government of Odisha spoke on "Information Delivery to the Citizens and Transparency in the System as Measures to Curb Corruption."

The Hindi Fortnight was observed from 14 to 29 Sep 2010.

B. Behera

Shri Manmohan Praharaj, IPS (left) gives a certificate to Shri M.K. Nayak.

B. Behera

Dr Karabi Datta delivered the 19th Gopinath Sahu Memorial Lecture.

Technology Week Observed

The Technology week was observed from 7 to 11 Mar 2011 at KVK, Koderma. During the Technology Week, 510 farmers and farmwomen participated in different programmes.

Institute Seminar

Dr Joanne U. Smith, University of Aberdeen, Scotland, United Kingdom, spoke on the "ECOSSE–Simulating Greenhouse Gas Emission across Different Temporal and Spatial Scale" on 20 Oct 2010.

Prof Pete Smith, Institute of Biological and Environmental Sciences, University of Aberdeen, Scotland, spoke on the "Global Green House Gas Mitigation Potential in Agriculture" on 20 Oct 2010.

Dr Karabi Datta, Professor, Department of Botany, University of Calcutta, Kolkata delivered the 19th Gopinath Sahu Memorial Lecture on "Designer GM Rice" on 2 Nov 2010.

Prof. S.K. Dubey, Assistant Professor, Department of Botany, Banaras Hindu University, Varanasi spoke on the "Methanotrophs: Useful Microorganism for Environment" on 18 Nov 2010.

Rajyogini Brahmakumari Sarala spoke on the "Yogic Meditation on Productivity and Quality of Agricultural Crops including Rice" on 19 Nov 2010.

B. Behera

Joanne U. Smith, spoke on the "ECOSSE-Simulating Greenhouse Gas Emission across Different Temporal and Spatial Scale."

Distinguished Visitors

B. Behera

Dr Damodar Rout visited CRRI, Cuttack on 23 Apr 2010.

Dr S.K. Dutta visited CRRI, Cuttack on 11 Jan 2011.

CRRI, Cuttack

Dr Damodar Rout, Hon'ble Minister of Agriculture, Department of Co-operation, Fishery and Animal Husbandry, Government of Orissa on 23April 2010 and 27 Nov 2010.

Dr Binayak Rath, Vice-Chancellor, Utkal University, Bhubaneswar on 22 Apr 2010.

Shri Manmohan Praharaj, IPS, Director General of Police, Government of Orissa on 1 Nov 2010.

Drs V.P. Gupta, Advisor, Department of Biotechnology, Ministry of Science and Technology, New Delhi and N.K. Singh, National Professor, IARI, New Delhi on 24 Nov 2010.

Dr E.A. Siddiq, Former Deputy Director-General (Crop Science), ICAR, New Delhi on 27 Nov 2010.

Dr G. Kalloo, Vice-Chancellor, JNKVV, Jabalpur on 6 Dec 2010.

Dr A.R. Pathak, Vice-Chancellor, Navsari Agricultural University, Navsari, Gujarat on 9 Dec 2010.

Dr S.K. Dutta, Deputy Director-General (Crop Science) on 11 Jan 2011.

Award

Courtesy: NAAS

Shri B.L. Joshi (second from right) gives the
Dr N.S. Randhawa Memorial Award to Dr T.K. Adhya (left). Dr R.B. Singh is on right.

Dr N.S. Randhawa Memorial Award

DR T.K. Adhya, Director, CRRI was awarded the Dr N.S. Randhawa Memorial Award of the National Academy of Agricultural Sciences, New Delhi for the biennium 2009-10 for his outstanding contributions in soil, water and environmental sciences and natural resources management. The award was conferred upon Dr Adhya by the Governor of Uttar Pradesh, His Excellency Shri B. L. Joshi at the inaugural function of the X Agricultural Science Congress held at National Bureau of Fish Genetic Resources, Lucknow on 10 Feb 2011.

Personnel

Staff Strength as on 31 March 2011

	Posts at CRRI, Cuttack			Posts at KVK, Santhapur			Posts at KVK, Koderma		
Category	Sanctioned	Filled	Vacant	Sanctioned	Filled	Vacant	Sanctioned	Filled	Vacant
Scientist	115	84	31	4	2	2	1	1	-
Technical	179	126	53	11	7	4	11	8	3
Administrative	94	84	10	2	1	1	2	1	1
Supporting	165	88	77	2	-	-	2	2	-
Canteen	5	-	-	-	-	-	-	-	-
Sub-total	558	387	171	19	12	7	16	12	4
RMP	1	1	-	-	-	-	-	-	-
Total	559	388	171	19	12	7	16	12	4

T.K.Adhya ..... Director

Crop Improvement

O.N. Singh ..... Principal Scientist and Head
..... from 11 Nov 2010

Plant Breeding

R.N. Rao ..... Principal Scientist
G.J.N. Rao ..... Principal Scientist
S.R. Dhua ..... Principal Scientist
K. Pande ..... Principal Scientist
J.N. Reddy ..... Principal Scientist
A.Pattnaik ..... Principal Scientist
Meera Kumari Kar ..... Senior Scientist
S.K.Pradhan ..... Senior Scientist
L.K. Bose ..... Senior Scientist
K. Chattopadhyay ..... Senior Scientist
S.K. Dash ..... Senior Scientist
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 ..... Scientist (SG)

Biotechnology

Pankaj Kaushal ..... Principal Scientist
Lambodar Behera ..... Senior Scientist
Bijoya Bhattacharjee ..... Senior Scientist
Sanghamitra Samantaray ..... Senior Scientist
B.S. Subramanian ..... Scientist
J.L. Katara ..... Scientist

Crop Production

Agronomy

K.S. Rao ..... Principal Scientist
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. Shukla ..... Principal Scientist, till 26 Mar 2011
A. Nayak ..... Principal Scientist, from 21 Jun 2010
P. Bhattacharyya ..... Senior Scientist
Sangita Mohanty ..... Scientist
Mohammad Shahid ..... Scientist
A. Kumar ..... Scientist, from 15 Apr 2010

Soil Science/Soil Physics/Soil Water Conservation

K.R. Mahato ..... Principal Scientist, till 31 Jul 2010
Rahul Tripathi ..... Scientist

Microbiology

T.K. Dangar ..... Principal Scientist
B. Ramakrishnan . Senior Scientist, till 15 May 2010
U. Kumar ..... Scientist, from 16 Sep 2010

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. ChoudhuryPrincipal Scientist, till 30 Nov 2010

Crop Protection

Anand Prakash ..... Principal Scientist and Head

Plant Pathology

Urmila Dhua ..... Principal Scientist
S.N. Tewari ..... Principal Scientist
G. Bhaktavastalam ..... Senior Scientist,
..... till 30 Jun 2010
K.M. Das ..... Senior Scientist
S.K. Singh ..... Scientist (Sr. Scale)

Entomology

Jagadiswari Rao Principal Scientist, till 30 Sep 2010
S. Sasmal ..... Principal Scientist
K.S. Behera ..... Principal Scientist
Mayabini Jena ..... Principal Scientist
P.C. Rath ..... Senior Scientist
V. Nandagopal ..... Senior Scientist, till 30 Sep 2010

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
T.B. Bagchi ..... Scientist, from 17 Sep 2010

Plant Physiology

D.P. Singh ..... Principal Scientist
R.K. Sarkar ..... Principal Scientist
Sanjukta Das ..... Principal Scientist, till 31 Jan 2011
Padmini Swain ..... Principal Scientist
M.J. Baig ..... Senior Scientist
Neeta Dwivedi ..... Senior Scientist

Biophysics

Pramila Krishnan ..... Senior Scientist,
..... till 15 May 2010

Social Science and Extension, Communication and Training

B.N. Sadangi ..... Principal Scientist and Head
..... from 16 Apr 2010

Agricultural Statistics

N.P. Jambhulkar ..... Scientist

Agricultural Economics

Parshuram Samal ..... Principal Scientist

Arun Pandit ..... Senior Scientist

Extension

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

Prakash Kar ..... Sr. Photographer

P.K. Mohanty ..... Artist, till 31 Jan 2011

Automobile Unit

K.K.Swain ..... Mechanical Engineer

Farm Unit

D.S. Meena ..... Training Assistant and
..... I/c Farm Supdt.

Dispensary

P. Mohapatra ..... Medical Officer, till Jun 2010

CRURRS, Hazaribag

M. Variar ..... Principal Scientist and OIC

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

M.S. Anantha ..... Scientist

RRLRRS, Gerua, Assam

K.B. Pun ..... Principal Scientist and OIC

S. Lenka ..... Senior Scientist

Narayan Bhakta ..... Scientist (Sr. Scale) and I/c

B.S. Satapathy ..... Scientist

KVK, Santhapur

S.M. Prasad ..... Senior Scientist

K. Vanitha ..... Scientist

J.R. Mishra ..... Sr. Trg. Asstt.

P.K. Mallick ..... Sr. Training Assistant

Sujala Sethy . SMS (Home Science), from 2 Aug 2010

D.R. Sarangi .. SMS (Soil Science), from 21 Dec 2010

T.R. Sahoo ..... SMS (Horticulture), from 1 Jan 2011

M. Chourasia ..... SMS (Plant Protection),
..... from 1 Feb 2011

KVK, Jainagar, Koderma

V.K. Singh ..... Senior Scientist

A. Dandapat ..... Sr. Training Assistant,
..... expired on 10 May 2010

Chanchila Kumari ..... Sr. Training Assistant

Sudhanshu Sekhar ..... Sr. Training Assistant

Mahesh Pathak ..... Sr. Training Assistant,
..... till 2 Jul 2010

B. Singh ..... SMS (Horticulture), from 26 Nov 2010

Administration and Finance

D. Moitra ..... Chief Administrative Officer,
..... from 20 Sep 2010

S.K. Sinha ..... Senior Administrative Officer,
..... till 7 Dec 2010

D.C. Sahoo ..... Administrative Officer

P.C. Naik ..... Administrative Officer,
..... from 23 Mar 2011

S.R. Khuntia . Senior Finance and Accounts Officer,
..... from 22 Jan 2011

Projects and Financial Resources

Institute Projects

Programme 1: Genetic Resources and Seed Technology
Programme 2: Genetic Enhancement of Yield
Programme 3: Improvement of Grain and Nutritional Quality
Programme 4: Breeding for Resistance / tolerance to Biotic, Abiotic and Environmental Stresses
Programme 5: Natural Resource Management and Input-use Efficiency for Improved Crop Production
Programme 6: Enhancing and Sustaining the Productivity of Rice-based Farming Systems
Programme 7: Mechanization for Rice Production and Post-harvest Systems
Programme 8: Strategic Research on Pathogens / pest Population Dynamics, Crop Losses, Forecasting
Programme 9: Developing IPM Technologies for Different Rice Ecologies
Programme 10: Socio-economic Research for Sustainable Development

Externally Aided Projects

There are a total of 50 EAPs at the institute. These are funded by the Indian Council of Agricultural Research, Department of Agriculture and Cooperation, Department of Science and Technology, ICAR-International Rice Research Institute, and the Department of Biotechnology.

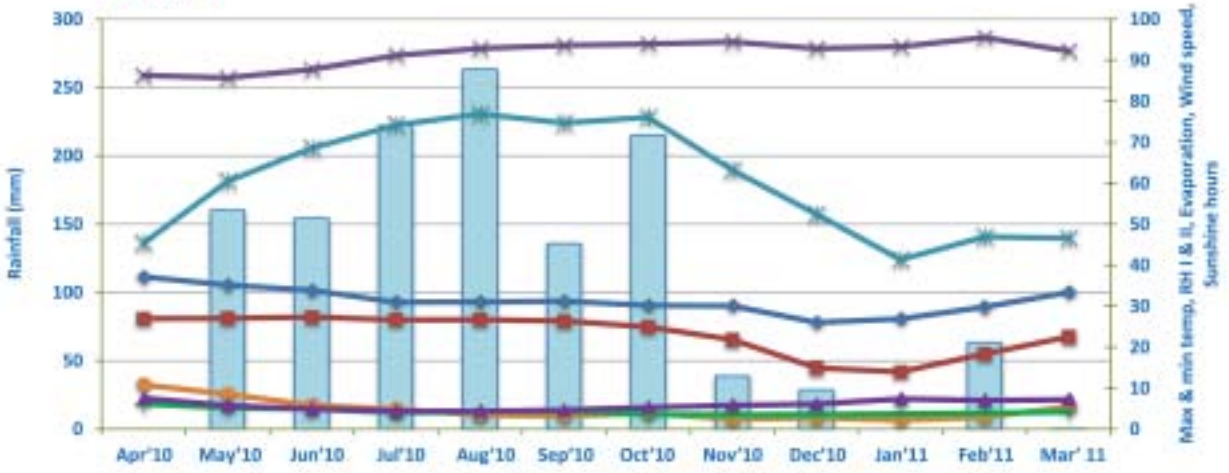
Financial Statement for 2010-11 (Indian ₹ in lakhs)

(As on 31 Mar 2011)

	Plan		Non-Plan	
Head of Account	Allocation	Expenditure	Allocation	Expenditure
Estt. Charges (including wages)	0	0	2,376.33	2,376.33
TA (including HRD)	28.13	28.13	15.00	15.00
OTA	0	0	0.40	0.38
Other Charges (including I.T.)	290.86	290.86	286.17	286.17
Works (Major / R&M)	81.00	81.01	57.50	57.50
Total	400.00	400.00	2,735.40	2,735.38
Revenue Generated: ₹ 73.79 lakhs				

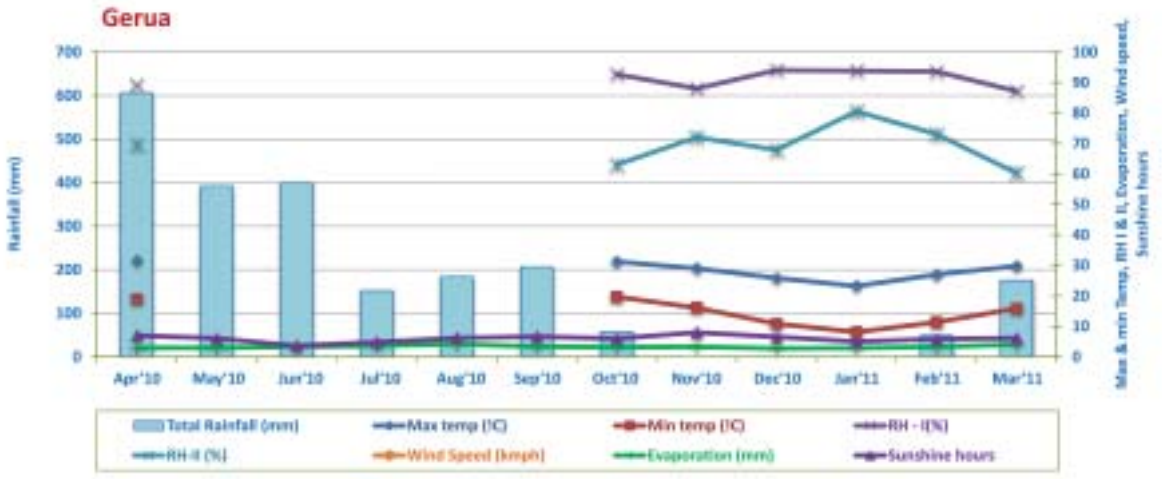
Weather

Cuttack



Hazaribagh

Gerua



Acronyms

AAU	:	Assam Agricultural University
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
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
BB / BLB	:	Bacterial Leaf Blight
BMGF	:	Belinda and Bill Gates Foundation
BPH	:	Brown Planthopper
Bt	:	*Bacillus thuringiensis*
CAC	:	Consortium Advisory Committee
CIAE	:	Central Institute of Agricultural Engineering, Bhopal
CIC	:	Consortium Implementation Committee
CIFA	:	Central Institute of Freshwater Aquaculture, Bhubaneswar
CMS	:	Cytoplasmic Male Sterile / Sterility
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
DFF	:	Days to 50% Flowering
DH	:	Dead Hearts
DNA	:	Deoxyribonucleic Acid
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
EAP	:	Externally Aided Projects

EC / ECe : Electrical Conductivity
EIRLSBN : Eastern India Rainfed Lowland Shuttle Breeding Network
FLD : Frontline Demonstration
FYM : Farmyard Manure
g : Gram
GLH : Green Leafhopper
GM : Green Manuring / Gall Midge
h : Hour
ha : Hectare
HI : Harvest Index
HRR : Head Rice Recovery
HYV : High-yielding Variety
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
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
MAS : Marker-assisted Selection
MB : Medium Bold
MLT : Multilocation Trial
MS : Medium-slender
NAARM : National Academy of Agricultural Research Management, Hyderabad
NAAS : National Academy of Agricultural Sciences
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

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
NSN	:	National Screening Nursery
NSP	:	National Seed Project
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
RTV / RTD	:	Rice Tungro Virus / Disease
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
SRI	:	System of Rice Intensification
STRASA	:	Stress Tolerant Rice for Poor Farmers in Africa and South Asia
t	:	Tonne
UBN	:	Uniform Blast Nursery
URSBN	:	Upland Rice Shuttle Breeding Network
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

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