

### iii. Contributions of other ICAR Institutes

## National Rice Research Institute (NRRI), Cuttack Odisha

The outbreak of devastating epiphytotic brown spot disease of rice (*Helminthosporium spp*) in 1942 in the then Bengal Province (the areas of which are now in the state of West Bengal in India and Bangladesh) resulted in a serious shortage of rice that culminated in the Great Bengal Famine of 1943. Due to this famine, the Central Government in 1944, decided to intensify research on all aspects of rice crop. In 1945, the Government of India decided to establish a central Institute for rice research. As a result, the Central Rice Research Institute (CRRI) was setup on 23 April 1946 at Bidhyadharpur, Cuttack, Odisha with an experimental farm land of 60 hectares provided by Government of Orissa. Dr. K. Ramiah, an eminent rice breeder, as its founder Director. Subsequently, in 1966, the administrative control of the institute was transferred to the Indian Council of Agricultural Research (ICAR).



It was renamed as National Rice Research Institute (NRRI) since 2015. The Institute has two research stations- Central Rainfed Upland Rice Research Station (CRURRS), Hazaribagh, in Jharkhand, and the Regional Rainfed Lowland Rice Research Station (RRLRRS), Gerua, in Assam. These research stations were established to tackle the problems of rainfed uplands, and flood prone rainfed lowlands, respectively.



### Major Contributions

AICRIP, renamed as the Indian Institute of Rice Research, was commissioned at Hyderabad in 1965 and functioned as a part of Central Rice Research Institute till 1988. Since the inception of Co-ordinated project, CRRI has been a major participant

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in coordination besides its own research activities. After the establishment of All India Coordinated Rice Improvement Project (AICRIP), the genotypes were evaluated in multilocation testing program and NRRI could release its first variety Padma in 1968. Through AICRIP, genotypes were evaluated in 14 ecosystems and NRRI contributed nearly half of the entries. These genotypes suitable for low land were highly promising. On an average NRRI conducts 35 AICRIP trials each year suitable for different ecosystem except for hills.

During the period 1965-2015 NRRI had released 114 rice varieties for different ecosystems which were tested through AICRIP programme. Out of these, 21 were suitable for upland, 7 for aerobic, 41 for irrigated, 2 for boro, 21 for shallow lowlands, 12 for semi deep, 4 for deep water, and 4 for coastal saline areas. Out of these the varieties like Vandana, Annada and Sahbhagidhan are popular in upland ecosystem; Naveen, Shatabdi, Ajaya, Rajalaxmi and very old variety like Ratna are popular in irrigated ecosystem. Similarly recently released submergence variety Swarna Sub-1, Savitri, Pooja, Dharitri and Gayatri are popular in low land areas. The variety developed by NRRI for unfavorable condition like CR-1014, Varsadhan, Sarala, and Durga are suitable for semi deepwater condition are popular with the farmers. The varieties developed for coastal saline condition Lunishree for wet season and Luna Sankhi for dry season are well accepted. Recently NRRI also identified a high protein rice CR dhan-10 suitable for irrigated areas. It has 10.3 % protein content in comparison to 6% in normal condition.

Besides these, many genotypes were also used as parents for developing high yielding varieties in different centers and were also directly released in other rice growing countries.

## Varieties released/ identified

### Varieties for Upland ecosystem

**Vandana (RR 167-982):** It is an early maturing (90-95 days) variety, released and notified (1992 & 2002 & 2002) for upland situation of Odisha and Chhotanagpur plateau. It is a short statured (95-110 cm) genotype has tolerance to drought and soil acidity. It has long bold grain quality with moderate resistance to blast and brown spot. It has an average productivity of 3.5 t/ha.



**Shabdagidhan (IR 74371-70-1-1-CRR-1):** It is an early duration (100 days) dwarf statured (85-90 cm) highly drought tolerance popular variety suitable for upland, rainfed direct seeded as well as transplanted conditions. It is released and notified (2008 and 2011, respectively) for cultivation in state of Jharkhand and Odisha. It bears golden husked long bold grains and has average productivity of 3.8 -4.5 t/ha. It is resistant to leaf blast and moderate resistant to brown spot, sheath rot, stem borer, and leaf folder etc.



### Varieties for Irrigated Medium lands

**Satabdi (CR 146-7027-224):** It is a mid-early duration (120 days) variety suitable for irrigated ecosystem and released and notified (2000) for cultivation in state West Bengal. It bears excellent quality long slender grains and has an average productivity of 4.0-5.0 t/ha. This variety is moderately resistant to bacterial leaf blight, sheath blight and Sheath rot etc. It has vast seasonal adoptability, can grow under all rice growing season of the year. It has quick maturing ability so that could be harvested before pre- monsoon rain; therefore, it is most popular for cultivation during dry season. It could be taken up in place of local boro/dry season varieties.



**Naveen (CR 749-20-2):** It is a mid-early duration (115-120 days) semi-dwarf (105cm) variety suitable for upland and irrigated ecosystem. It is released and notified (2005 and 2006) for cultivation in Odisha, West Bengal, Tripura and Andhra Pradesh. It has medium bold grains with average productivity of 4.0-5.0 t/ha in Kharif and 5.0-6.0 t/ha in Rabi season. This variety has resistance capability against stem borer, blast and brown spot. It could be cultivated in place of Lalat variety.



## Varieties for Shallow lowlands

**Gayatri (CR 210-1018):** It is a late duration (160 days), semi tall (110 cm) photosensitive popular variety, released and notified (1988) for cultivation in low land of state Odisha, West Bengal and Bihar. It has short bold good cooking quality grains with average productivity of 5.0 t/ha. It has field tolerance against major diseases and pests. It has significant extent of grain dormancy, can tolerate up to 50 cm water stagnation and suitable for delayed transplanting.



**Pooja (CR-629-256):** It is a late duration (150 days) short height (90-95cm) popular variety, released and notified (1999/1999) for cultivation in shallow low land area of states, Odisha, Assam, Madhya Pradesh and West Bengal. It has medium slender grains and gives an average yield of 5.0 t/ha. It possesses field tolerance to all major diseases, pests. It tolerates water stagnation (up to 25 cm) and suitable for late transplanting with aged seedlings.



**Swarna Sub-1 (CR AC 2539-1):** It is a late duration (143 days) semi dwarf (100 cm) variety, released and notified (2009) for cultivation in low land area of Odisha. It can tolerate complete submergence for two weeks, because of incorporation of Sub-1 gene (submergence tolerance gene) in the genetic background of the popular mega variety Swarna. Hence it is a solution to the problem of inundation due to flash floods in coastal areas. It has brighter panicle colour than Swarna and bears medium slender grains with an average productivity of 5.0-5.5 t/ha. It has field tolerance against all major diseases and pests.



## Varieties for Semi deep water conditions

**Sarala (CR 260-77):** It is a late duration (160 days) semi tall (110-120 cm), non-lodging, photosensitive variety, released and notified (2000) for cultivation in semi deep water/ coastal area of Odisha. It has medium slender grains possesses seed dormancy and has an average productivity of 4.0 t/ha. It is highly popular among the farmers because of grain quality and has got an advantage that aged seedling (up to 50 days old) can be transplanted without any yield loss. It can tolerate a submergence situation up to 50 cm.





**Varshadhan (CRLC 899):** It is a long duration (160 days), tall (150 cm) non-lodging, stiff strewed photosensitive popular variety, released and notified (2005 and 2006) for cultivation in low land area of the state Odisha, West Bengal and Assam. It has long bold grains with average productivity of 4.0 t/ha. It is tolerant to neck blast, bacterial leaf blight, sheath rot and white backed plant hopper. It can tolerate prolonged water logging up to a depth of 75 cm.



### **Varieties suitable for Coastal saline conditions**

**Luna Shankhi (CR 2577-1):** It is an early duration (110 days) variety, recently released and notified (2012 and 2013) for cultivation in irrigated condition in coastal saline area of Odisha. It has medium slender grains with average yield capacity of 4.6 t/ha. It is moderately resistant to blast and sheath blight and suitable for dry season cultivation.



**Luna Suvarna (CR LC2096-71-2):** It is a tall (135 cm) late maturing (150 days) salt tolerant (5.0 to 8.0 dsM-1) variety, recently released and notified (2010 and 2011) for cultivation in coastal saline area of Odisha. It has medium slender grains with an average productivity of 3.5 to 4.0 t/ha. It can also withstand with up to 45 cm water stagnation. It is recommended for early transplanting (before July 15th) with 40 days old seedlings.



- **Identification of germplasm/breeding lines for drought tolerance at seedling/vegetative and reproductive stages:** Moisture stresses may occur during any stage of the crop growth with varying durations leading to yield loss of 20-80% even some time 100%. For such situations the rice varieties with built in tolerance to drought will be of paramount importance. So there is urgency in identifying more and more donors to evolve better varieties with higher drought tolerance coupled with higher grain yields, in view of the fast changing environments.
- About 10,000 rice germplasm lines comprising upland rice, lowland rice, deep water rice, wild rice, advanced breeding lines and fixed lines are screened under simulated stress condition during dry seasons since 2001 till date and about 370 lines were identified as vegetative stage drought tolerant by SES score '1' following SES method (1-9 scale) at soil moisture content of 5 - 8 % and ground water table down below 100 cm.



### Field Screening for drought tolerance under controlled irrigation and simulated stress

- Seven genotypes (Zingsaingma; Lucharxgur-Metraxbram; Nachin II; Patnaigosaba; Mahulata; Brahamana Nakhi and WGP 9) are confirmed as best tolerant lines under rainfed upland condition. These lines experienced three drought spells (8-10 days each time) exhibiting yield potential more than 1.0 t ha<sup>-1</sup> and are being used as donors for varietal development programme.
- Three land races Mahulata (AC No. 35186) collected from the farmers field in Chipilima village of Sambalpur district of Orissa, Brahman Nakhi (AC- 35678) collected from the farmer's field in Baliapada village of Jagatsinghpur district and Sal-kaiin (AC- 34992) collected from the farmer's field in Sarsara village of Sundargarh district of Orissa state are identified as a new sources of vegetative stage drought tolerance and are registered in NBPGR, New Delhi.
- A breeding line CR 143-2-2 developed at CRRI, Cuttack-6 is identified as a vegetative as well as reproductive stage drought tolerant rice variety, yielding more than 1.2 t ha<sup>-1</sup>.
- Mapping population of Mahulata x IR 20 is being developed and field phenotyping of 360 lines is under progress in the current season.
- Two wild rice accessions of *Oryza nivara* (IC -330470 and IC -330611) collected from West Bengal are also identified as vegetative stage drought tolerant lines (SES '0' & '1') and are being used in breeding programme.
- Sahabhagidhan (IR 74371-70-1-1, IET 19576) is released as a drought tolerant variety in the state of Jharkhand, Orissa from the combined effort of IRRI-India Drought Breeding Network.



## Crop Production

Since long, Scientists in the Agronomy Department / Section have been involved in the AICRIP program studying different aspects of crop management of rice under varying ecologies.

Following areas of studies were addressed across the rainfed favorable and unfavorable lowlands including deepwater rice and irrigated ecologies in the Agronomy over the seasons.

- IVT, AVT-I and AVT-II of promising pre-released rice cvs./ genotypes,
- Stand management namely dry and wet DSR, SRI, sowing / planting geometry,
- Nutrient management mostly N from different sources both organic / natural and inorganic / chemicals,
- Weed management both chemical (new formulation) and mechanical,
- Aerobic rice, and
- Dry season / Boro rice

## Crop Protection

- Since the establishment of a unit of the AICRIP at CRRI, the institute has contributed immensely to rice crop protection activities. The Entomology and Pathology units of CRRI are actively contributing under HPR, continuously screening the genotypes for resistance against several diseases and insects, particularly for blast, BLB, sheath blight, tungro, brown spot, brown plant hopper, stem borers, leaf folder, gall midge rice root-knot and seed borne nematode.
- Both the units of NRRI (Formerly CRRI) have actively participated in evaluating different synthetic chemicals/botanicals each year and provide data on reaction against NRRI insect populations and disease strains. The biotype monitoring of BPH and gall midge is being continuing from this location and the change in population reaction to different known gene differentials is being reported time to time. The Institute also worked on various aspects such as optimum pest control method in pre-released varieties, yield loss assessment due to pests etc. The BPH-resistant donors and developed breeding lines of NRRI were also supplemented for multilocational testing under PHS and MRST of AICRIP.
- The donors CR Ac. No 34997(purified Salakathi), 35181 and 35184 (purified Dhobanumberi) as well as promising breeding lines developed from their introgression such as CR 2711-76, CR 2711-149, CR 2711-114, CR 2711 - 139, CR 3005 - 77-2, CR 3005-230-5, CR 3006-8-2 were also found highly promising under multilocational trial.