

COIMBATORE

Department of Rice, Centre for Plant Breeding and Genetics
Tamil Nadu Agricultural University
Tamil Nadu

The Department of Rice, previously known as “Paddy Breeding Station” is a constituent of the Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore established in 1912 and is the oldest rice research station in the modern India.



Analysis of head rice recovery
using hand operated rice mill

Major Contributions to AICRIP

Crop Improvement

Varieties/hybrids identified/released

The contribution of this department after AICRIP includes 20 rice varieties and four hybrids which have remarkably improved the rice cultivating horizon of the state.

Latest varieties released include:

CO (R) 50 - A CVRC release CO (R) 50 is the new plant type rice variety released by Central Variety Release Committee for South India. On an average the variety produces 7.0 tons per ha but often farmers harvest 10.0 tons per ha.

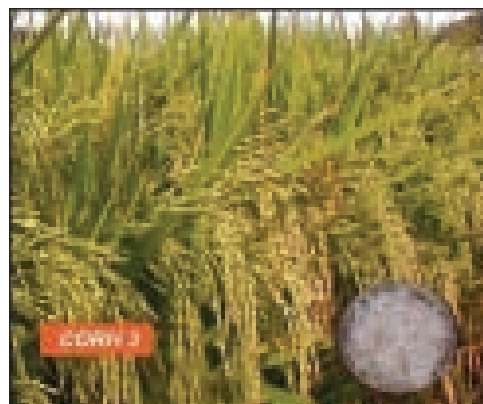
Rice CO 51: Recently released high yielding short duration variety is matching with the demands of the farmers across the state to have fine rice, multiple resistant

and high yielding variety with resistance to blast and BPH. It has superior grain and cooking quality and fetches good market price.

CR 1009 sub 1- A submergence tolerant rice variety for the regions of the tail end of coasted delta districts namely Thanjavur, Tiruvarur, Nagapattinam of Tamil Nadu states about 1-1.5 lakh ha is affected by submergence.

CORH 3 – Notified hybrid for all over India is creating bench mark in rice productivity among the early maturing breeds by often yielding 10.0 tons per ha.

TNAU Rice Hybrid CO4 – A CVRC release is one of the first medium slender rice hybrid from the public sector. Gujarat State Seed Corporation and M/s Rasi Seeds Pvt. Ltd are marketing this hybrid on an MOU with TNAU.



List of rice varieties released in Coimbatore post inception of AICRIP

Varieties	Year	Duration	Special Features
CO 33	1970	105	Short, round grain, non lodging
CO 34	1970	115	Heavy yielder, wider adaptability
CO 35	1970	100-105	Early, high yielding
CO 36	1973	130	Photo-thermo insensitive
Bhavani*	1973	130-135	Direct introduction, long slender quality rice
CO 37	1974	115-120	Resistant to sheath blight, wider adaptability
CO 38	1975	145-150	Blast resistant
CO 39	1975	90-95	Short duration
CO 40	1977	165-175	Heavy yielder, tolerant to blast
CO 41	1979	100-105	Fine rice, low nitrogen responsive
CO 42	1979	135-140	Tolerant to BPH
CO 43*	1982	135-140	Fine grain, tolerant to alkalinity and salinity
CO 44	1983	130-135	Suited for late sown conditions
CO 45	1990	135	Resistant to blast, BLB and RTV
CORH 1	1994	115	First hybrid rice in India, medium slender rice
CO 46	1997	125-130	BPH resistant
CORH2	1998	135	Medium slender white rice non lodging tolerant to alkalinity & salinity

CO 47*	1999	110-115	Medium slender white rice resistance to blast.
CORH 3*	2006	115	First non-aromatic good grain quality rice hybrid.
CO (R) 48*	2007	135	Moderately resistant to blast. Suitable for thaladi season
CO (R) 49*	2008	135	Fine quality, medium slender white rice. Suitable for thaladi season.
TNAU Rice CO 50*	2010	135-140	First 'super rice' - new plant type attributes. Yields 7.0 tons/ ha on an average and resistant to blast.
CORH 4*	2011	130-135	It is a medium duration (130 - 135 days) rice hybrid
CO (R) 51*	2013	105	Resistant to blast and BPH
CR1009Sub 1*	2015	145	Tolerate up to 15 days of submergence when compared with CR 1009

Accomplishments through AICRIP - Crop Improvement

Sl. No	Particulars	Products / Numbers
1	Number of varieties/hybrids released	20 varieties & 4 hybrids
2	Number of CVRC release	One variety CO 50 & One Hybrid CORH 4
3	Number of Entries nominated	169 for the past 15 years
4	Number of entries promoted	46 for the past 15 years
5	Resistant donors identified for biotic stresses	95 for the past 15 years
6	Resistant donors developed & identified for abiotic stresses	16 for the past 15 years
7	Germplasm Enrichment through AICRIP	3500
8	Popularization of technologies	1907
9	Training activities conducted	3162 Beneficiaries

Crop Production

Agronomy

- *Standardization of seed rate:* Based on the duration groups, seed rate was standardized for short duration (60Kgha⁻¹), medium duration (40Kgha⁻¹), long duration (30kgha⁻¹) and hybrids (15 Kgha⁻¹) for transplanted puddled rice.
- *Seed treatment:* includes treatment with Carbendazim or Pyroquilon or Tricyclozole solution; treatment with *Pseudomonas fluorescens*; seed treatment with biofertilizers.
- *Optimum age of seedlings:* For quick establishment found to be 18-22 days for short, 25-30 days for medium and 35-40 days for long duration varieties.

- *Root dipping with biofertilizers: Azospirillum and Phosphobacteria or Azophos* inoculant in 40 litres of water for 15 - 30 minutes before transplanting was standardized.
- **Weed management:** Pre emergence herbicide formulations were standardized viz., pretilachor at 1.0 kg a.i. ha⁻¹ on 3 DAT + weeding with Twin row rotary weeder at 40 DAT; Pyrazosulfuron ethyl 10 % WP @ 150 g ha⁻¹ on 3 DAT + hand weeding (HW) on 45 DAT; Butachlor 0.75 kg a.i. ha⁻¹ + bensulfuron methyl 50 g ha⁻¹ on 3 DAT + HW on 45 DAT; Oxadiazon 87.5 g a.i. ha⁻¹ followed by Post emergence (POE) 2,4-D 1 kg a.i. ha⁻¹ along with hand weeding on 35 DAT; PE butachlor 0.75 kg per hectare + bensulfuron methyl 50 g ha⁻¹ on 3 DAT followed by mechanical weeding on 45 DAT is effective for broad spectrum weed control. Post - emergence herbicide, Bispyribac Sodium 50 g a.i./ha found to be effective
- **Evaluation of different crop establishment methods for increasing the yield in transplanted rice:** Drill seeding method recorded significantly higher grain yield followed by broadcasting method. SRI method gave 20 per cent higher grain yield over standard transplanting at Coimbatore. Among the crop establishment methods tried SRI method recorded the highest grain yield followed by Integrated Crop Management. In a study on evaluation of age of seedlings, nutrient, weed and water management practices under SRI system, it was found that higher yields could be realized when all the package of practices were adopted under SRI.
- **System of Rice Intensification:** Planting of 15 days old seedlings combined with four times cono weeding recorded higher grain yield. The studies on long term effects of nutrition on SRI vis a vis conventional flooded rice in rice+ rice cropping system revealed that rice crop under SRI method of establishment recorded higher grain yields. Direct seeding with SRI was also found to be promising as compared to conventional transplanting. SRI with 100% recommended inorganic fertilizers recorded higher grain yield and was comparable with 50 % inorganic + 50% (equivalent of N dose) organic.
- Standardization of agro techniques for indigenous aromatic rice; package



of practices for hybrid rice, rotational irrigation under puddled direct sown condition and selective mechanization for enhancing productivity and profitability of rice cultivation have been worked out.

Plant Physiology

- The parental lines BRB223-2-2-2-1R, C10R, IR58103-62-3R, PMS10B, IR 60821-34-13R and IR65515-47-2-19R identified as physiologically efficient high yielder based on optimum LAI, higher CGR, more dry matter, high stem thickness, higher chlorophyll, soluble protein, grain yield and harvest Index. So these genotypes can be utilized as parental lines to develop hybrids.
- Spent wash and GA_3 ($30g\ ha^{-1}$) + BR (0.3 ppm) combination spray resulted in better panicle exertion in hybrid rice. By delaying sowings, number of days for attaining panicle initiation stage was reduced by 6 days, while the reproductive and grain filling (ripening) period got increased by one day.
- Identified suitable donors with higher Fe and Zn content in grain viz., Jaya, Mandya vijaya, HRRH-1094 and Mugadh sugand. The variety BPT 5204 was found to possess good responsiveness to three nitrogen levels (0, 100 and 200 kg/ha) with higher yield. This was closely followed by other hybrids Ajaya, PA 6444, KRH 2 and NDR 359.
- Node number as a developmental indicator for identifying the panicle initiation (PI) stage under different cumulative degree days (CDD) and cumulative nyctoperiod (CNP) conditions under photothermic study identified IET 20924, IET 21113, IET 21119 cultures as promising.
- Hybrid CORH 3 (4.5 %) and Naveen (6.2 %) had lower yield reduction under intermittent irrigations and may be recommended for water scarce areas of intermittent irrigation.
- In silicon treatments, combination of both foliar spray as Na silicate (0.5%) and silicon solubilizer-carrier molecule imidazole (0.2%) influenced lower light transmission ratio (8.3) and higher leaf area index (5.8) at 50 % flowering there by increased biomass accumulation during cropping period. Among 14 wild species, *O. rufipogon*, *O. punctata* and *O. longistaminata* exhibited highest photosynthesis, and



O. rufipogon was the best wild resource species for improving photosynthesis among all species tested.

Crop protection

Entomology

IPM module was developed and recommended the following practices

- *Pseudomonas fluorescens* - Seed treatment (10 g/kg), seedling dip (2.5 kg/ha), main field application (2.5 kg/ha)
- Pest and disease management in nursery (preferably neem seed kernel extract 5% or Neem oil 2%)
- Integrated nutrient management - use of neem cake coated urea (5 : 1); inclusion of green manures / biofertilizers; 'N' management by Leaf Colour Chart (LCC); 'K' application: basal (50%) + one top dressing (50%); Adoption of cultural practices.
- Variety selection, spacing based on season, location (endemic / hot spot); Rogueing space (1' for every 8').
- Water management - alternate wetting and drying and submergence at recommended level during critical periods only.
- Release of biocontrol agents, when the moth activity is noticed; *Trichogramma japonicum* for stem borer @ 1,00,000 (5 cc) ha⁻¹ at weekly interval for 3 times, *T. chilonis* for leaffolder @ 1,00,000 (5 cc) ha⁻¹ at weekly interval for 3 times
- Set up bird (owl) perches @ 40 to 50 ha⁻¹
- Neem seed kernels extract application - 5% against leaffolder.
- ETL based insecticide / fungicide application (no synthetic pyrethroids)
- Integrated rodent management includes narrow bund maintenance (45 x 30 cms), zinc phosphide baiting (49 : 1) & baiting with bromodialone, trapping with Thanjavur bow trap (100 nos./ha)



Pest scenario & Species complex

- During 2008, two outbreaks have been recorded. BPH outbreak in Gobichettipalayam area in ASD 16 nearing harvest (August end), cut worm caterpillar (*Mythimna separata*) outbreak in Pudukottai.
- During 2009, severe outbreak of planthoppers was noticed at Bhavani taluk

over an area of 4000 acres. Stray reports on such outbreaks were also reported in other places of Tamil Nadu and these are mainly due to improper use of insecticides.

- There was increase in planthoppers and stem borer incidence throughout the state, especially during October- November of 2010.
- Among the species complex of rice stem borers, yellow stem borer, *Scirpophaga incertulas* was predominant during vegetative, tillering and milky stage coinciding the months of October, November and December while pink borer population was more after January up to second week of February.

Non-chemical approaches of pest management

- Identified an efficient strain of *Beauveria bassiana* (B2) against rice pests and the formulation is given for testing under AICRIP in few centers.
- Field testing of *Beauveria* against leafhopper indicated that incidence was at par with profenophos treatment (3.79 -10.36 %) compared to 15.86 % in untreated check. Yellow stem borer incidence was also comparable with that of standard insecticide.
- Under SRI system, incidence of stem borer was found to be low in both CORH 3 (hybrid) and ADT 43 (High yielding variety) compared to normal planting while gall midge incidence was found to be more under SRI in CORH 3 than normal planting.
- Stem borer incidence was less in the direct sown crop compared to normal planting.

Evaluation of new chemicals for insect pest management

- Evaluated new insecticide molecules flubendiamide, chlorantraniliprole, imidacloprid, thiamethoxam and several combination products against rice pests and new acaricide molecules like diafenthiuron, abamectin spiromesifen etc.
- Conducted physical and chemical compatibility of new insecticide molecules with new fungicide molecules viz., Imidacloprid, thiamethoxam, flubendiamide, spinosad with isoprothialone, carpropamid and tricyclozole.
- Sulfoxaflor was found superior to standard check Monocrotophos in checking the planthopper population. Combination product Buprofezin + Acephate @1000g/ha was found effective against BPH and recorded higher yield.
- Benfuracarb 40 EC sprayed @ 500 g ai ha⁻¹ recorded the lowest incidence of BPH, GLH, stem borer and leafhopper and found comparatively safer to spiders and coccinellids.

- Flubendiamide 20 WDG (0.25g/l) and Spinosad 45 SC (0.25g/l) were physically and chemically compatible with Isoprothiolane and Carpropamid when mixed with @1.5 and 1.0 ml/l, respectively without causing any phytotoxic symptoms on rice plants and found effective against stemborer, leaffolder and blast.
- Acephate 95 SG @1.2 g/l and dinotefuron 20 SG @ 0.4g/l were physically and chemically compatible with hexaconazole 2.0 ml/l and tricyclazole @ 0.6ml/l and effective in checking planthoppers.
- Rynaxypyr (Coragen 20 SC) @ 0.30ml/l and Ethiprole + Imidacloprid (Glamore 80 WG) @0.25g/l were physically and chemically compatible with Tricyclozole (Baan 75 SP) @0.6g/l and Hexaconazole (Contaf 5 SC) @ 2.0ml/l.
- Imidacloprid (0.25 ml l⁻¹) and thiamethoxam(0.2 ml/l) were physically and chemically compatible with Propiconozle (1ml/l) and Validamycin (2.5 ml/l).
- Among the acaricides tested against leaf mite, Diafenthiuron @ 900 ml/ha and Fenpyroximate @ 600 ml/ha were effective in the field.

Identification of safer chemicals to natural enemies

- Thiamethoxam was found to be highly toxic among the insecticides tested to *T. chilonis* followed by Imidacloprid, Ethofenprox, Pymetrozine and Virtako® while Acephate was least toxic.
- Benfuracarb 40 EC @ 500 g ai/ha recorded the lowest incidence of BPH, GLH, stem borer, leaffolder and found comparatively safer to spiders and coccinellids.

Information on screening nurseries evaluation

Every year, almost 800-1000 entries were screened from the seed materials obtained from AICRIP, IRRI and TNAU cultures against BPH, WBPH and GLH. Apart from plant and leafhopper screening, leaffolder and stem borer screening works were also attempted based on the necessity.

- CB 02-290, RIC 06-0204, KAUM 103-104-1, KAUM 95-1 and RP 4636 -52-1-1-1-3-5 were moderately resistant to BPH and CB-01-001, CB 02-586, CB 04-041, CB 03-045 & TNRH 135 were found moderately resistant to WBPH.
- CB 20022- (AD 93019 / AD 41) was gall midge resistant to biotype 4 & 6.
- CB 02-586, CB 21006, TNRH 174, CR 2711-149 MTU 1115, MTU 1123 and MTU 1126 were identified as moderately resistant to both BPH and WBPH.
- RP 4680-1-2-23 and RP 4681-16-2-569 were found resistant to BPH, WBPH and GLH under Multiple Resistant Screening trial for consecutive two years.

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- Three cultures, CoRG 15, CoRG 24, CoRG 30 developed at TNAU, Coimbatore were nominated for gall midge resistance screening programme during 2013 and among them CoRG 15 and CoRG 24 were found promising.
 - In leafhopper screening trial (LFST) PTB I2, W 1263, LF 293 (IR 36 x LFR 831311) & SB 436 (CO 43 x W 1263) were found resistant for two years and suggested to use as donors. LF 333, LF 256 and 293 were found to be moderately resistant.
 - YSB 479, YSB 33 and YSB 301 were found promising against stem borer. Bt hybrids screened at Kuruvikarambai, Tamil Nadu identified MRP 5319, MRP 5445, MRP 5631 and MRP 5629 with low damage.

Plant pathology

Recent findings in RTD Management

- To control the vector, green leafhopper in the main field, spray two rounds of any one of the insecticides viz., Monocrotophos 36 SL (1000 ml/ha), Phosphamidon 40 SL (1000 ml/ha), Fenthion 100 EC (500 ml/ha) on 15 and 30 days after transplanting. The vegetation on the bunds should also be sprayed with the insecticides.

Blast

- A prediction model for rice Leaf Blast Epidemic for western Zone of Tamil Nadu was developed using ten years data.
- REMAP markers developed can be used reliably to study the population dynamics of the fungus.
- Cultivar IR64 (known to possess 9 blast resistance genes) was resistant at Coimbatore from 2005-2008, after which it became susceptible in both the locations. Cultivar Rasi (known to be a slow blasting one) was resistant at Coimbatore until 2010, while at Gudalore it was resistant until 2007 and became susceptible later with an exception in 2011.

False smut

- Spraying Kocide 2000 @ 525 g a.i/ ha at booting and milky stage recorded significantly less percentage of infected panicles/m² over control.