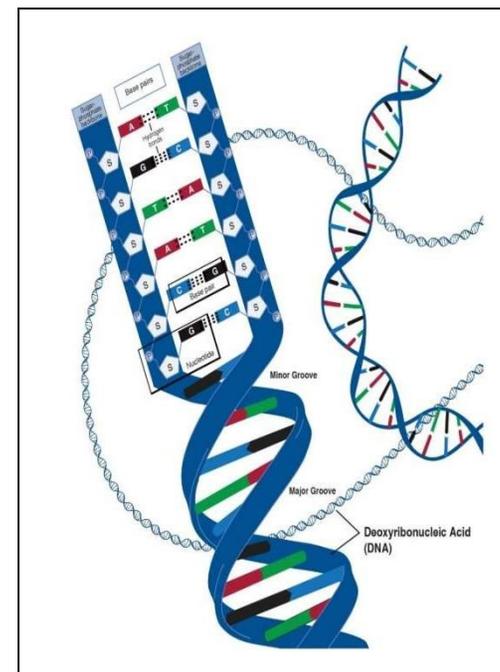




Biotechnology Division





Vision and Mission of Biotechnology Division

Vision: Development of modern rice variety and creating basic research information using different biotechnological tools.

Mission: Strengthening rice research and creating basic research information using different biotechnological tools for achieving sustainable food security



Mandate of Biotechnology Division

The mandate of the Biotechnology Division is to develop high-yielding, abiotic and biotic stress-tolerant and nutrient enriched variety through different biotechnological tools



Research Transformation of Biotechnology Division

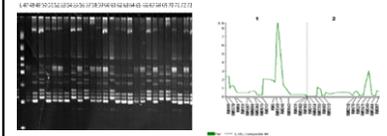
1991-2000 →

Tissue culture based work- methods and protocols have been established on culturing explants, such as seed, embryo, young panicle and anther



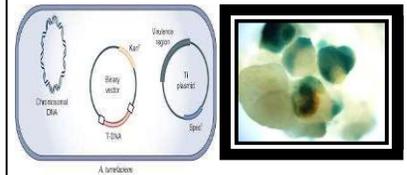
2001-2010 →

DNA fingerprinting, gene pyramiding, QTL identification and establishment of protocol for *Agrobacterium* mediated transformation



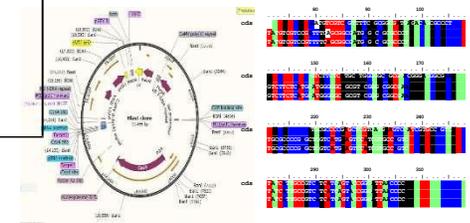
2011-2020 →

Genetic transformation, marker assisted selection (MAS), marker assisted backcrossing (MABC), introgression of QTL, isolation and gene cloning



2021 to date →

Genetic engineering, genome editing, C4 rice development and bioinformatics





Major Achievements of Biotechnology Division



BIRRI dhan86: A doubled haploid Boro rice variety



- Average yield 6.5 ton/ha
- Growth Duration 140-145 days
- Long slender grain
- 1000 grain weight 23.23 gm
- Amylose: 25 %
- Protein content: 10.1%
- Average plant height is 95 cm



Paddy



Milled rice

Cooked rice



BIRRI dhan87: A high yielding T. Aman rice variety



Average Plant height is 122 cm
Long slender grain
1000 grain weight 24.1gm
Amylose: 27.0%
Growth duration 125-128 days,
Average yield 6.5 ton/ha



Paddy

Brown Rice



Cooked rice

Milled Rice



BIRRI dhan89 - A high yielding Boro rice variety



Brown rice

- ✓ Average yield: 8.14 t/ha,
- ✓ Growth duration: 154-158 days
- ✓ Elongation ratio: 1.4
- ✓ Amylose: 28.5%
- ✓ 1000 grain weight : 24.4 gm

BIRRI dhan92 - A water saving Boro rice variety



Brown rice

- Average yield 8.44 ton/ha
- Amylose : 26%
- 1000 grain weight : 23.4 g
- Growth Duration 160 days
- Long slender grain



BIRRI dhan96 - A short duration protein enriched Boro rice variety



- Mean Plant height is 87cm
- Elongation ratio: 1.7
- Amylose: 28%
- Protein: 10.8%
- Growth Duration 140-145 days
- Ave. Yield 7.0 ton/ha.
- Paddy is light brown color with golden shades (swarna type grain)





Current Activities of Biotechnology Division



Development of rice variety through anther culture for----

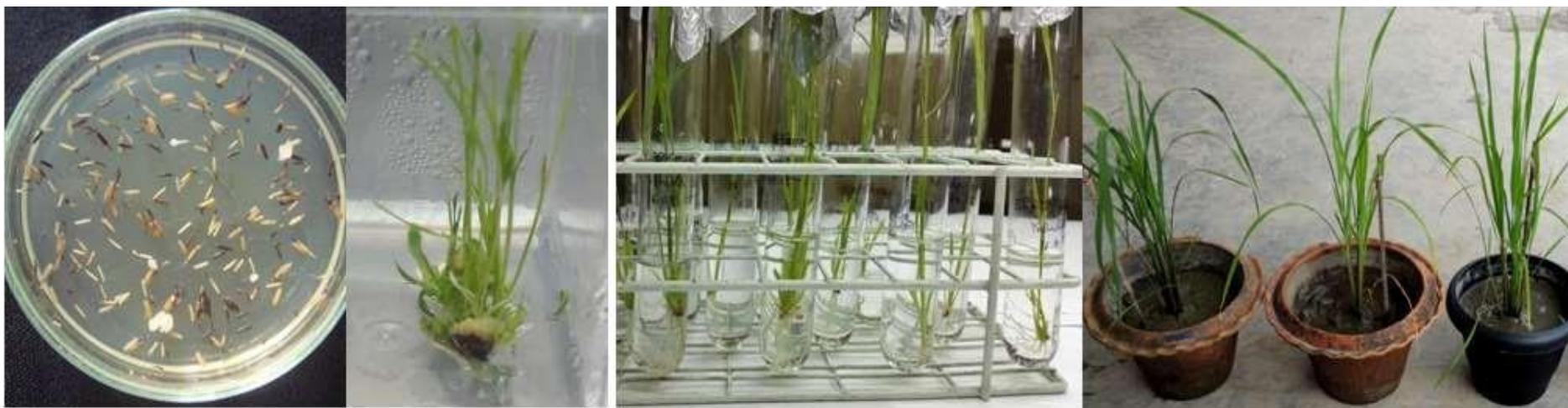
Low glycemic index (GI)

Salt tolerant

Premium quality

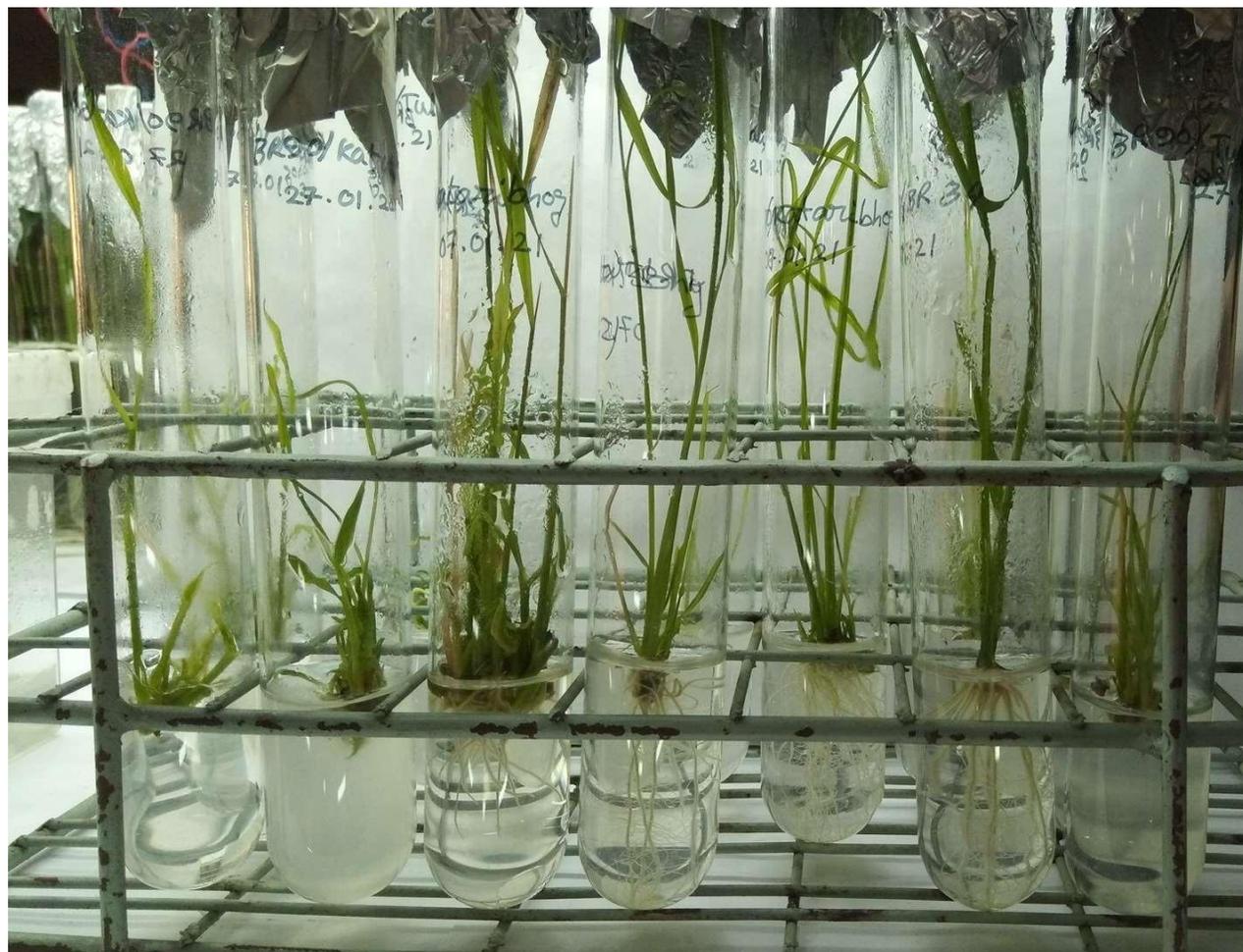
Short duration and high yielding Aus

Photoperiod sensitive





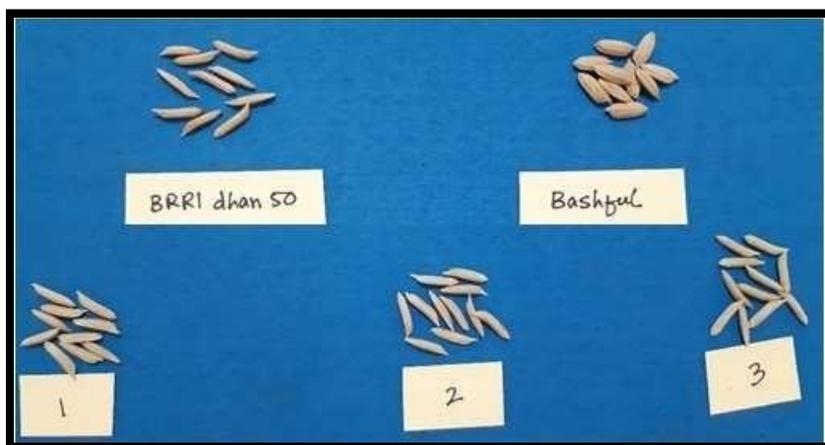
Development of premium quality rice variety through anther culture



Regenerated plants after anther culture for aromatic rice development.



Development of premium quality rice variety through anther culture



Paddy



Grain

Seeds derived from doubled haploid lines of BR50/ Bashful cross



Development of antioxidant enriched black rice variety through anther culture



Panicles and grains of doubled haploid lines BR(Bio)13028-AC11-3-1



Developing rice variety through wide hybridization followed by embryo rescue and anther culture



Embryo rescued plants from several crosses are now in different growth stages.

Development of rice variety through wide hybridization followed by embryo rescue



Seeds of pedigree lines derived from wide cross followed by embryo rescue of BIRRI dhan48/*O. glaberrima* (IRGC 105190)



Development of somaclonal variants using EMS treated rice seed



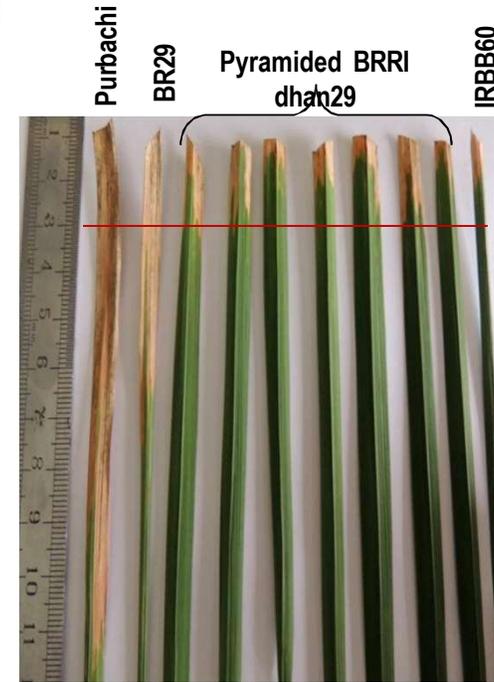
EMS treated somaclonal variants of BR11



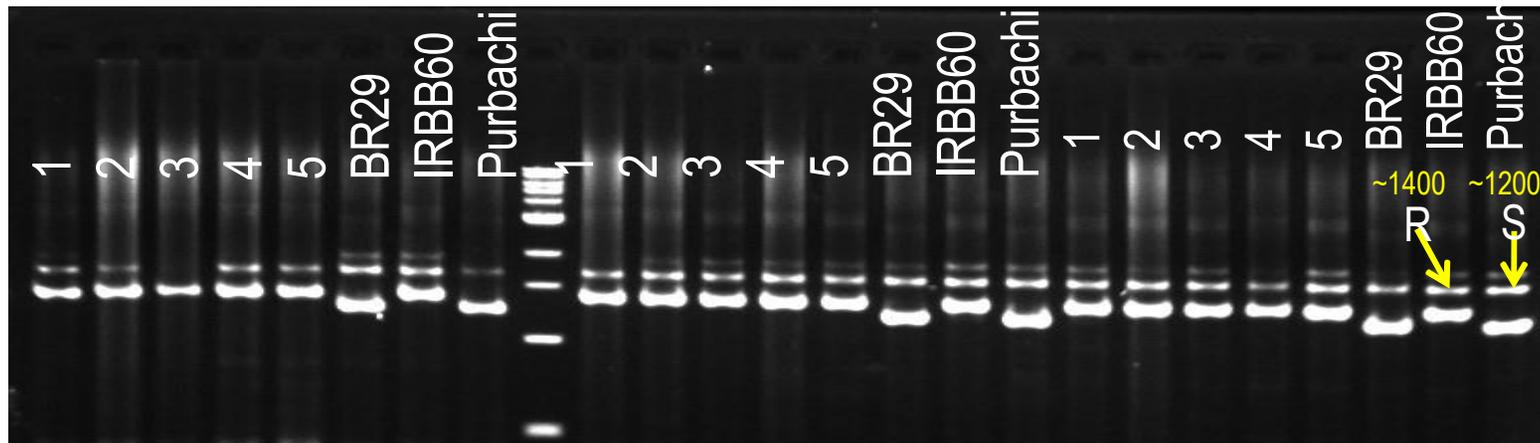
Two Bacterial Blight resistance genes (*Xa4* and *Xa21*) pyramided BIRRI dhan29



Field performance of BR(Bio)8333-BC5-2-16



21 days after bacterial inoculation with Bx09



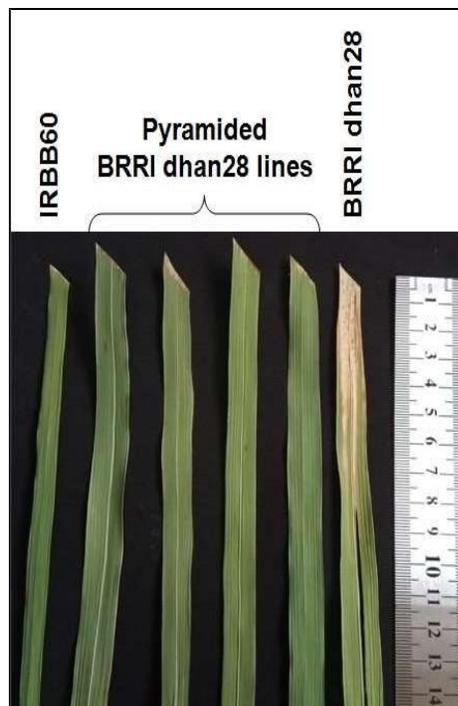
BB pyramided BIRRI dhan29 lines confirmed by PCR with *Xa21* gene specific primer (1, 2, 3, 4 and 5 = Sample from each entry)



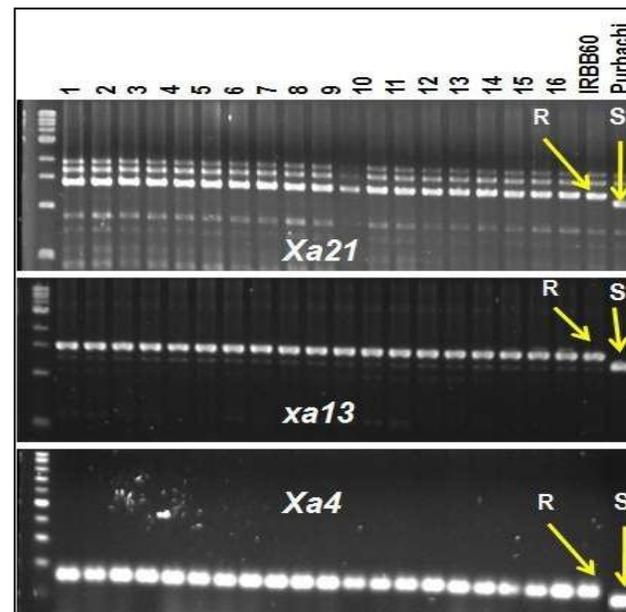
Three Bacterial Blight resistance genes (*Xa4*, *xa13* and *Xa21*) pyramided BIRRI dhan28



Field Performance of BB pyramided lines



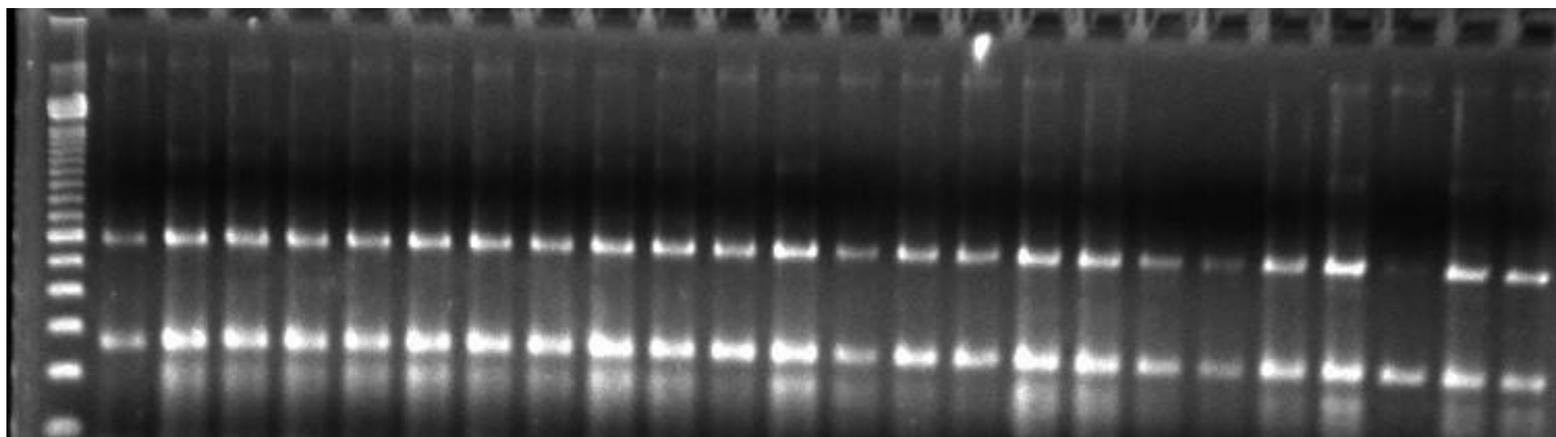
Disease reaction of BB pyramided lines after 21 days of inoculation with BxO9



BB pyramided BIRRI dhan28 lines confirmed by PCR with *Xa4*, *xa13* and *Xa21* gene specific primer



Marker assisted selection for fragrance gene in F_3 Population of BIRRI dhan87 and Kalijira.



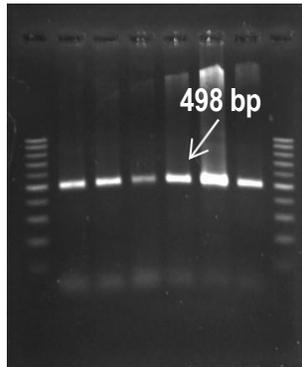
All tested aromatic lines were confirmed by using functional marker of fragrance gene *BADH2*.

Cloning of salt tolerant gene *PVA1*

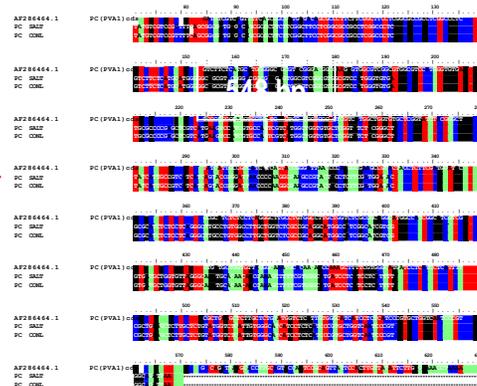


cDNA was synthesized from extracted RNA of treated *P. coarctata*

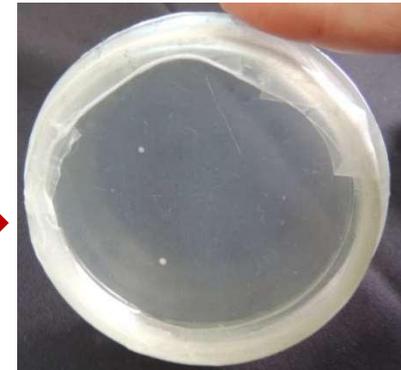
Confirmed by PCR with gene specific primer



Amplification of *PVA* from *P. coarctata*



Confirmed by Sequencing

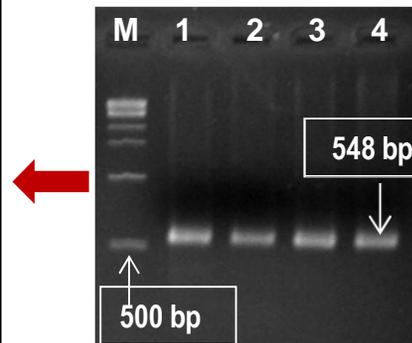


Cloning into TOPO TA cloning vector

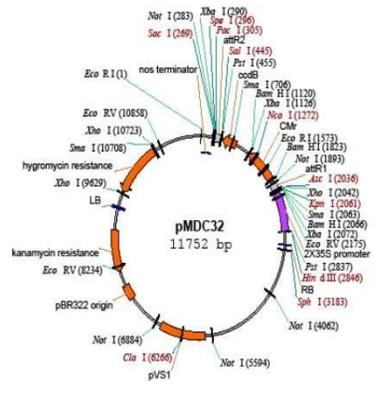
was ligated with *attB* adapter

Transformation in to *Agrobacterium LBA4404*

Gene construct is ready for transformation into rice



Confirmed by PCR with gene specific primer

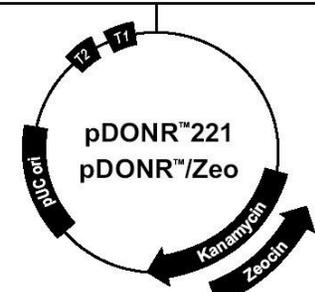


LR Clonase™

LR reaction

attB1 PVA *attB2*

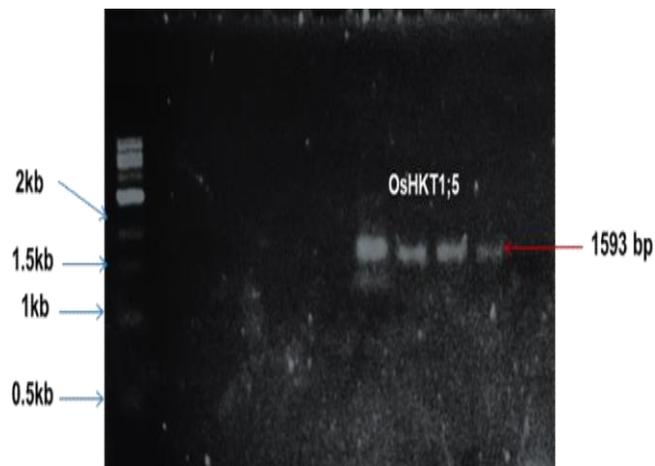
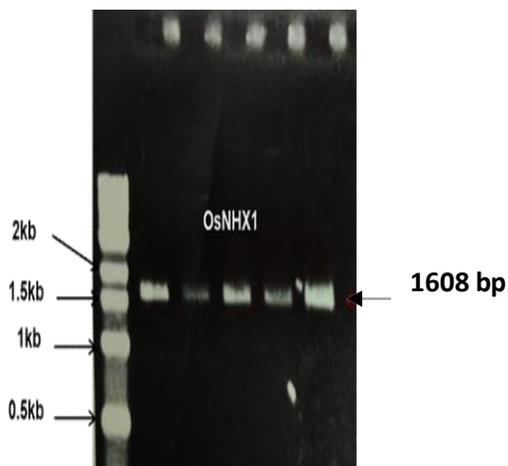
BP reaction ↓ BP Clonase™



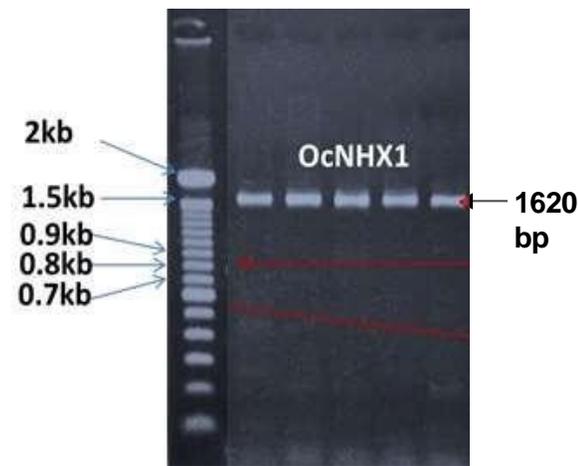
Isolation and cloning of salt tolerant genes



Pokkali and *Oryza coarctata* treated with salt



PCR Amplification of 1608 bp *OsNHX1* and 1593 bp *OsHKT1* gene from local rice cultivar Pokkali.



PCR Amplification of 1620bp of *OcNHX1* gene from *O. coarctata* rice genotypes

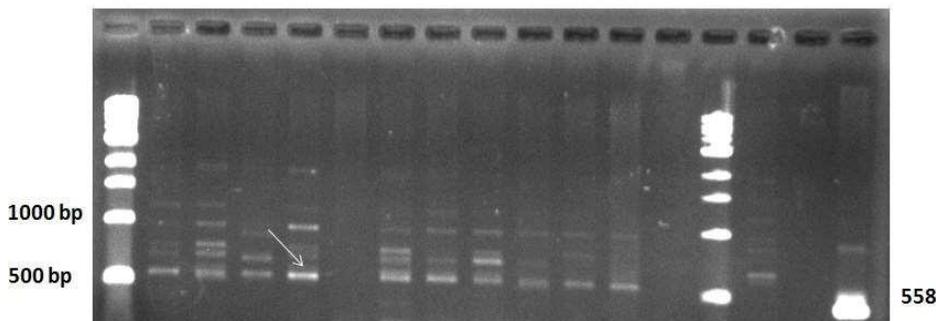
Development of salt tolerant transgenic rice



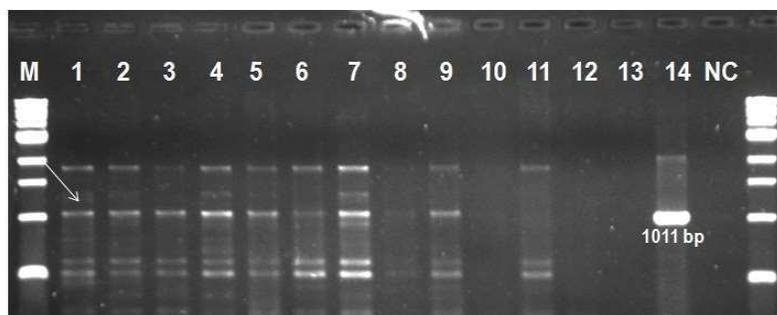
Putative transgenic plants having salt tolerance *GlyI* and *GlyII* gene were grown in the transgenic net house



M 1 2 3 4 5 6 7 8 9 10 11 12 M 14 NC PC



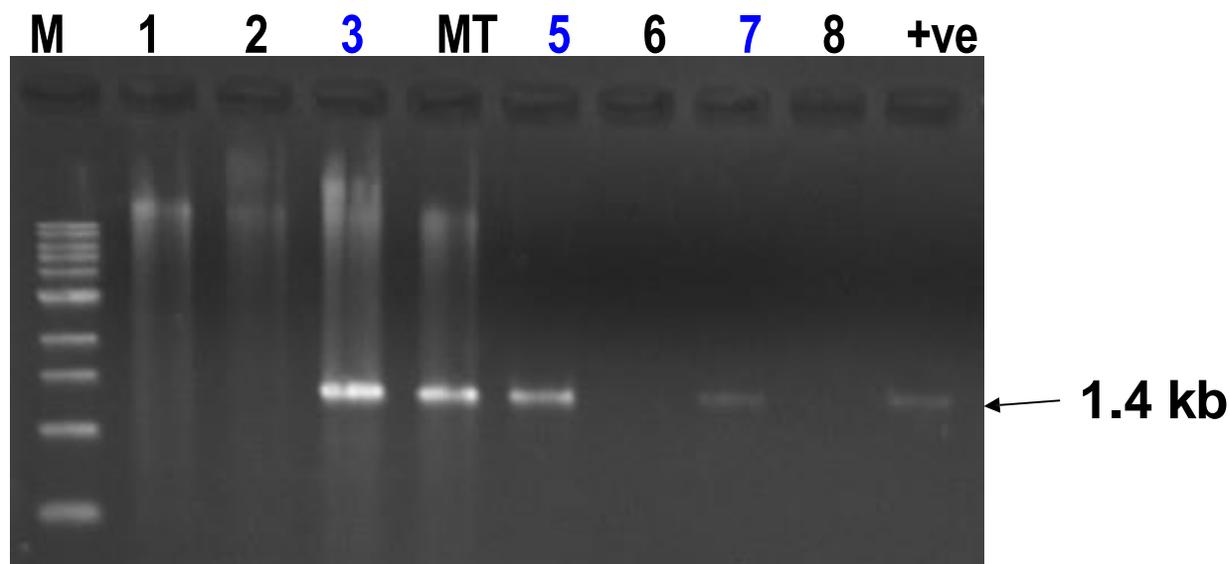
Putative transformants (T₄ generation) gene specific primer.



Putative transformants (T₄ generation) confirmed by *GlyII* gene specific primer.

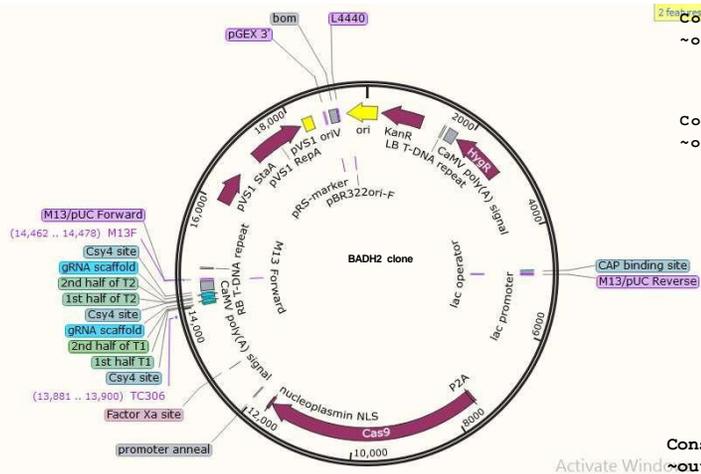


Introgression of salt tolerant mangrove gene

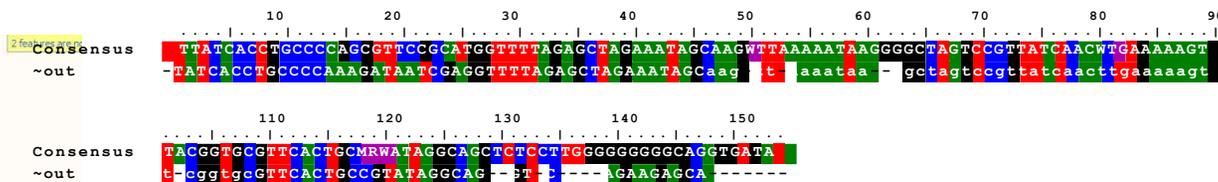


Three BC₂F₁ plants of BRRRI dhan28 were confirmed by gene specific primer.

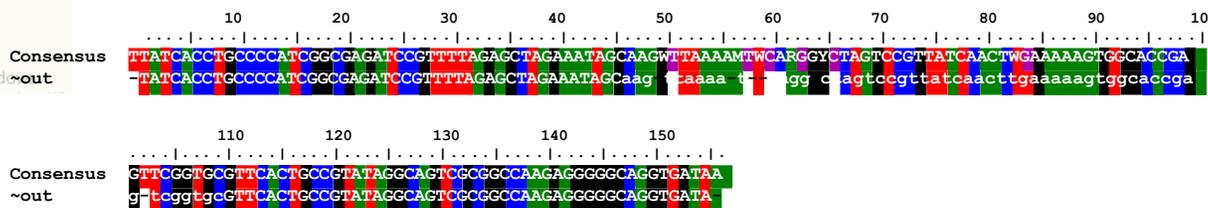
Development of high yielding aromatic rice lines through genome editing



Cloning vector with two inserts designed with SnapGene software

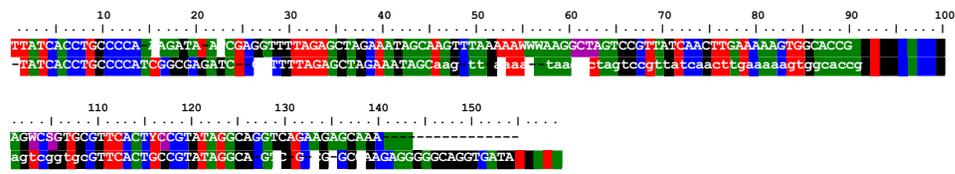
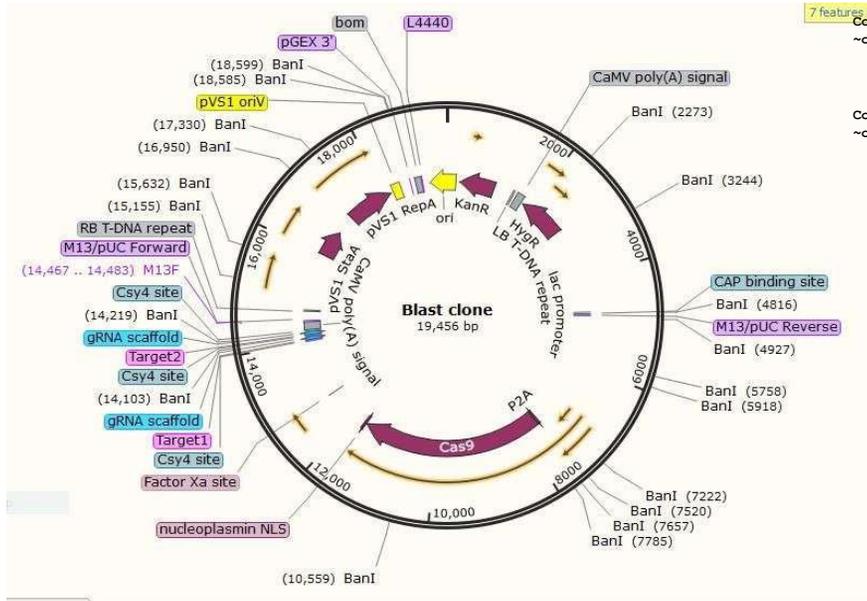


Comparison of second amplicon for aroma with the reference sequence.

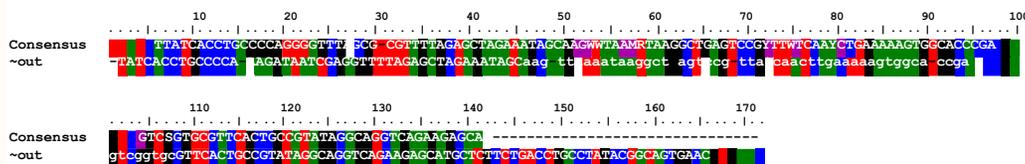


Comparison of third amplicon for aroma with the reference sequence.

Development of high yielding blast resistant rice lines through genome editing



Comparison of second amplicon for blast resistance with the reference sequence



Comparison of third amplicon for blast resistance with the reference sequence.

Cloning vector with two inserts designed with SnapGene software

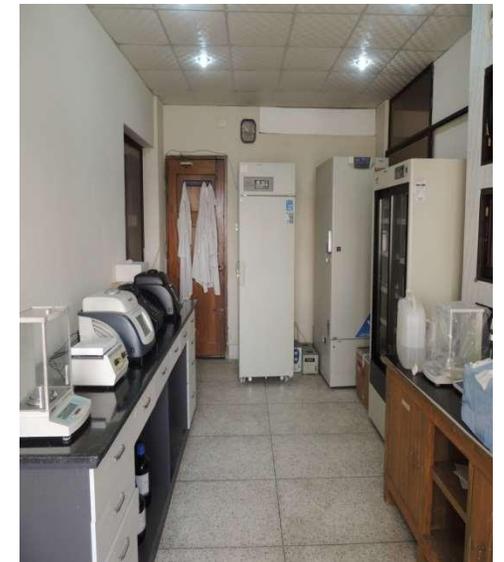
Identification of major regulators for C4 rice



M₃ Kaoun plants are subjected to CO₂ stress in low concentration (20 ppm) CO₂ chamber to detect mutant plant losing C4 photosynthetic property



Research Facilities at Biotechnology Division





Thank You