

Effective use of modern biotechnology and molecular breeding and associated methods as breeding tools

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Prehistoric selection for visible phenotypes that facilitated harvest and increased productivity led to the domestication of the first crop varieties - the earliest examples of biotechnology



Breeding progress

- Improved varieties
- High Yielding Varieties
- Green revolution
- Hybrids



- 1980s- The plant biotechnology era begins - transgenic plants using Agrobacterium produced in 1983
- Molecular marker systems for crop plants soon follow to create high-resolution genetic maps

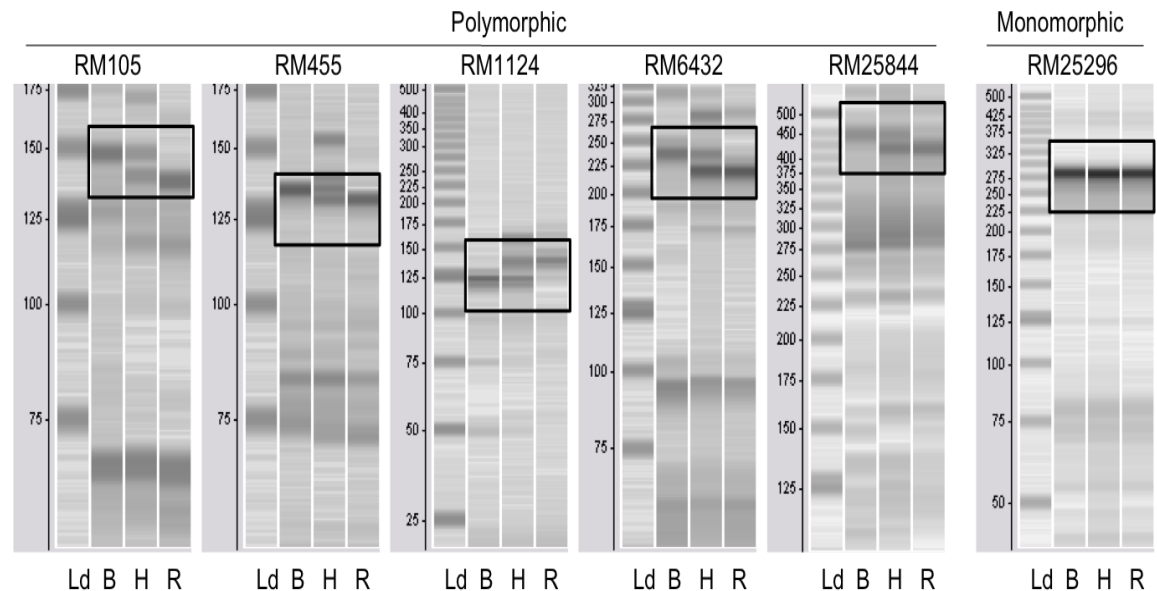


Application of Molecular tools to breeding procedures

- Molecular Plant Breeding Expands Useful Genetic Diversity for Crop Improvement
- Molecular Plant Breeding Increases Favorable Gene Action
- Molecular Plant Breeding Increases the efficiency of Selection –improved Year-on-year gains

Molecular breeding

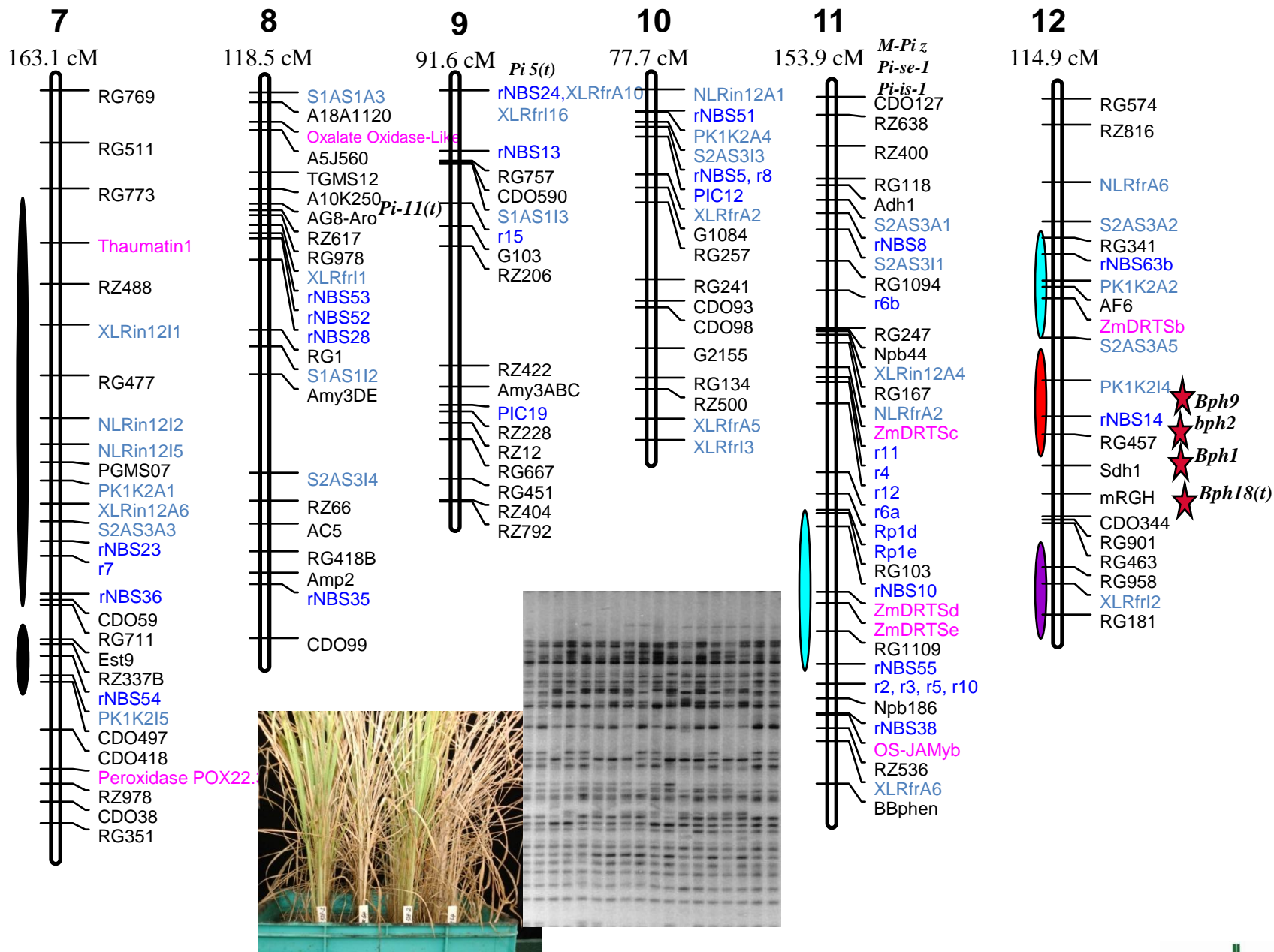
- Backcrossing program
- MAS
- Genome recovery
- Genetic diversity/heterotic grouping
- Fingerprinting
-



Host Plant Resistance to BPH in Rice Germplasm



(IRRI)



Drought tolerance in rice

Field evaluation - Phenotyping



Sources of germplasm



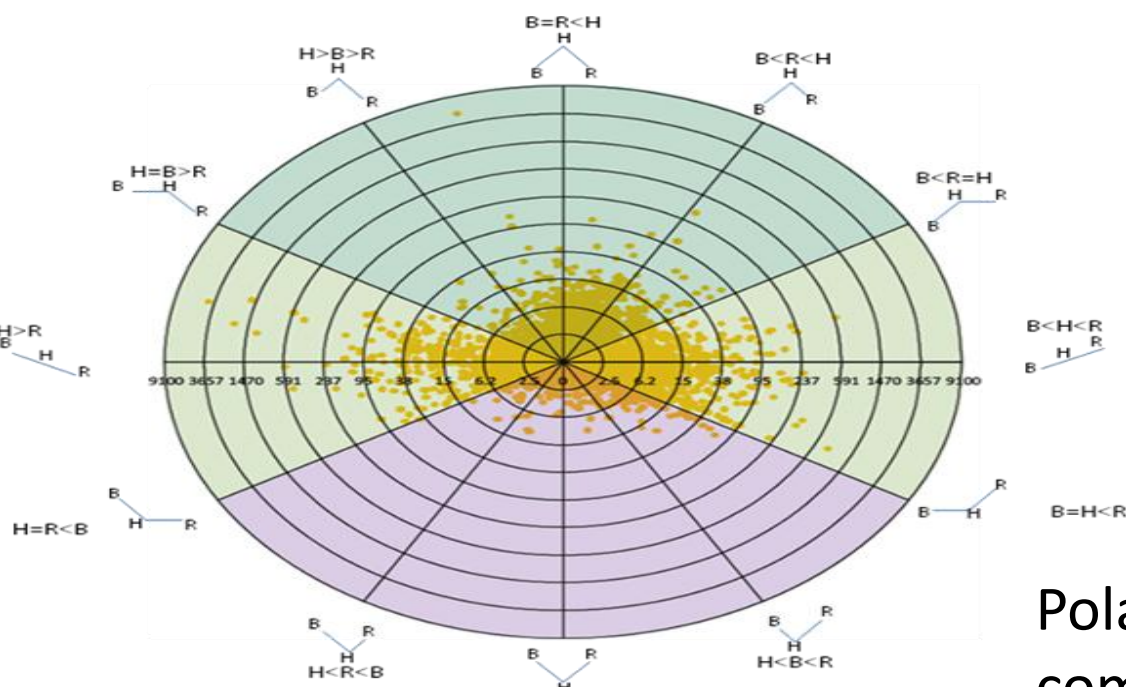
Drought

Molecular markers

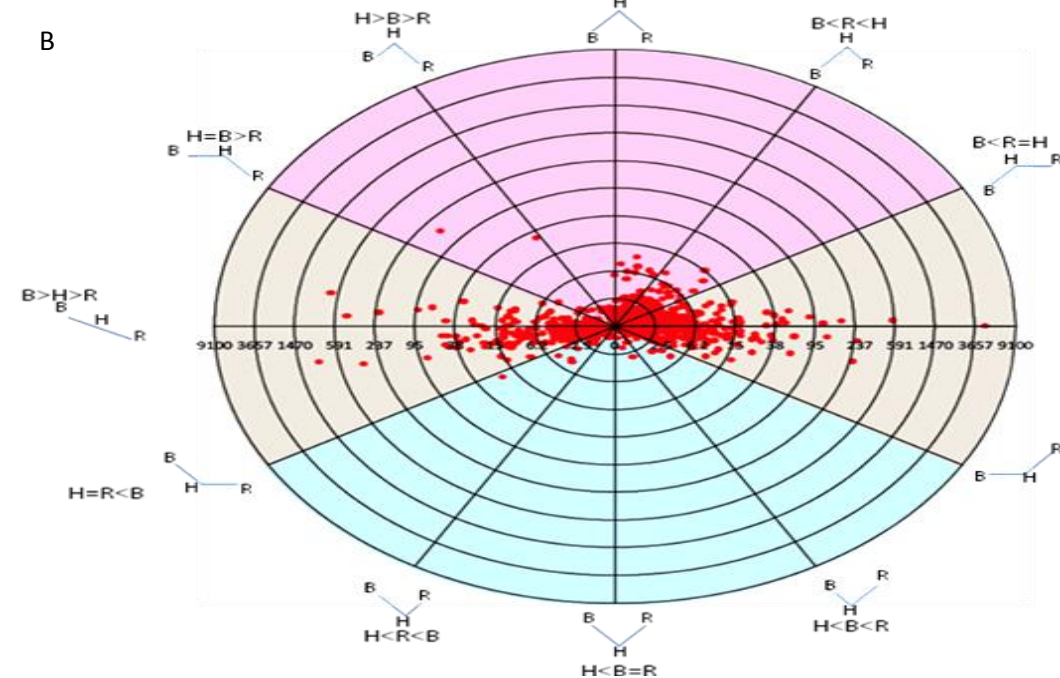
Transgenics



A



B



Polar graphs representing comparative transcriptome analysis of young (A) and mature (B) leaves

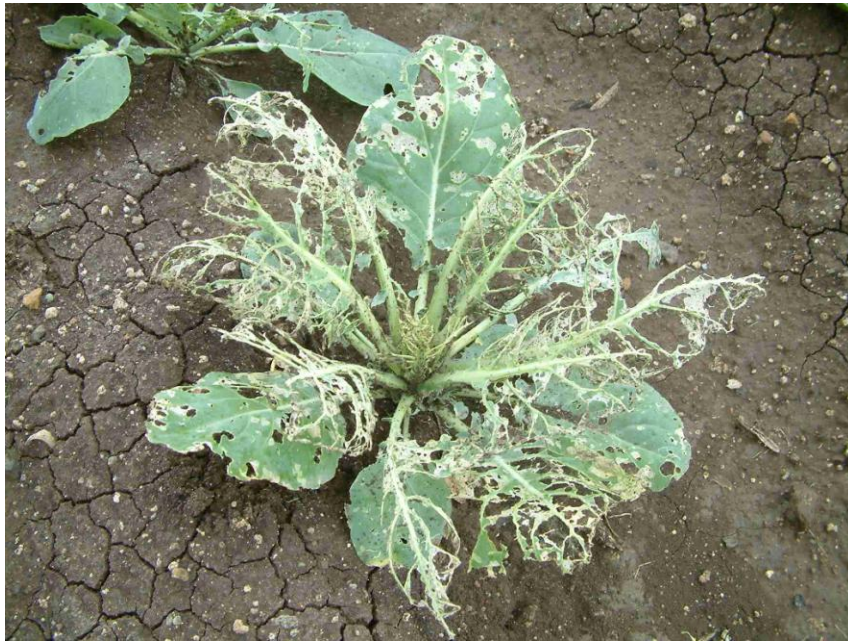
Why transgenic technology?

No known sources of tolerance

Conventional approaches not successful



- First generation traits
 - Insect tolerant crops
 - Herbicide tolerant crops
 - Disease resistant crops
- Looking ahead
 - Drought
 - Salinity
 - Fertilizer use
 - Yield per se



Insect tolerance



Virus tolerant crops

- Losses caused by the fruit and shoot borer alone is 50 to 70%
- 25-80 pesticide sprays per season



Salinity tolerance

- 900 m hectares of land affected by salt worldwide
- 33% of the world's irrigated land is affected by high salt
- 50% of the arable land will be salt-affected by 2050



NHX Salt tolerant plants



With gene

Control Plants

16 days of **50mM** NaCl stress

- Biotechnology is providing unprecedented options for enhancing plant breeding
- Molecular breeding and transgenic crops for improving productivity in a sustainable manner



