

Biotechnology in crop improvement

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Biotechnological approaches for crop improvement

Transgenesis

Molecular marker assisted selection

Transgenesis vs. Marker Assisted Selection (MAS)

An application of MAS in developing disease resistant rice varieties

Extending the scope of MAS

Transgenesis: involves introduction of an isolated gene into plant cells in such a manner that it is stably inherited through subsequent generations

Marker Assisted Selection: this is a variation of traditional plant breeding wherein DNA sequence differences are used to identify plant varieties that carry the desired traits

Marker assisted selection vs. Transgenesis

Marker assisted selection:

Advantages: Biosafety and Intellectual Property Rights are not major issues

Disadvantages: source of gene is restricted to the gene pool of the species

Transgenesis:

Advantages: Very precise technology; any gene from any organism

Disadvantages: Issues of Biosafety; Many of the enabling technologies are covered by patents

Marker assisted selection vs. Transgenesis

Marker assisted selection:

This method is used when the trait of interest is present within the gene pool of the crop of interest

Transgenesis:

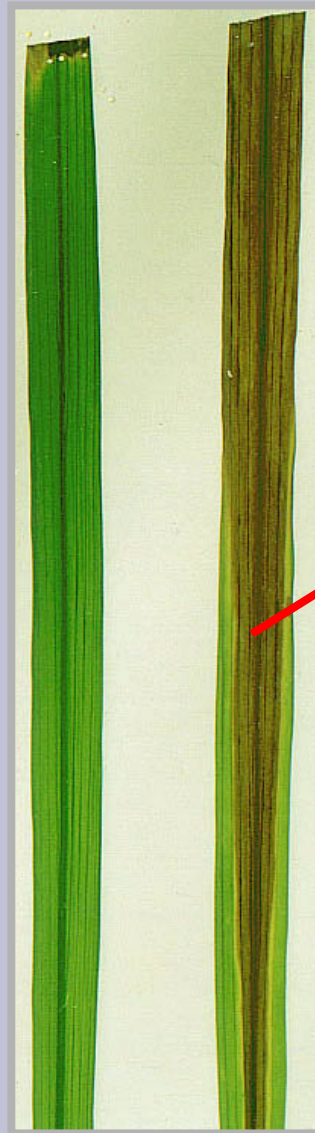
This method is used when the trait of interest is not present within the gene pool of the crop of interest

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Bacterial leaf blight is a serious rice disease



Disease Lesion

Normal Infected

- ➔ **Effective bactericides are not available for controlling the disease**
- ➔ **Bacterium can overcome rice cultivars containing single genes for resistance against the disease**
- ➔ **Rice cultivars should be developed that contain multiple genes for Bacterial Leaf Blight Resistance**

Samba Mahsuri

**Fine Quality,
Disease
Susceptible**

**Donor
Disease Resistant
Low yielding
Rice
variety**

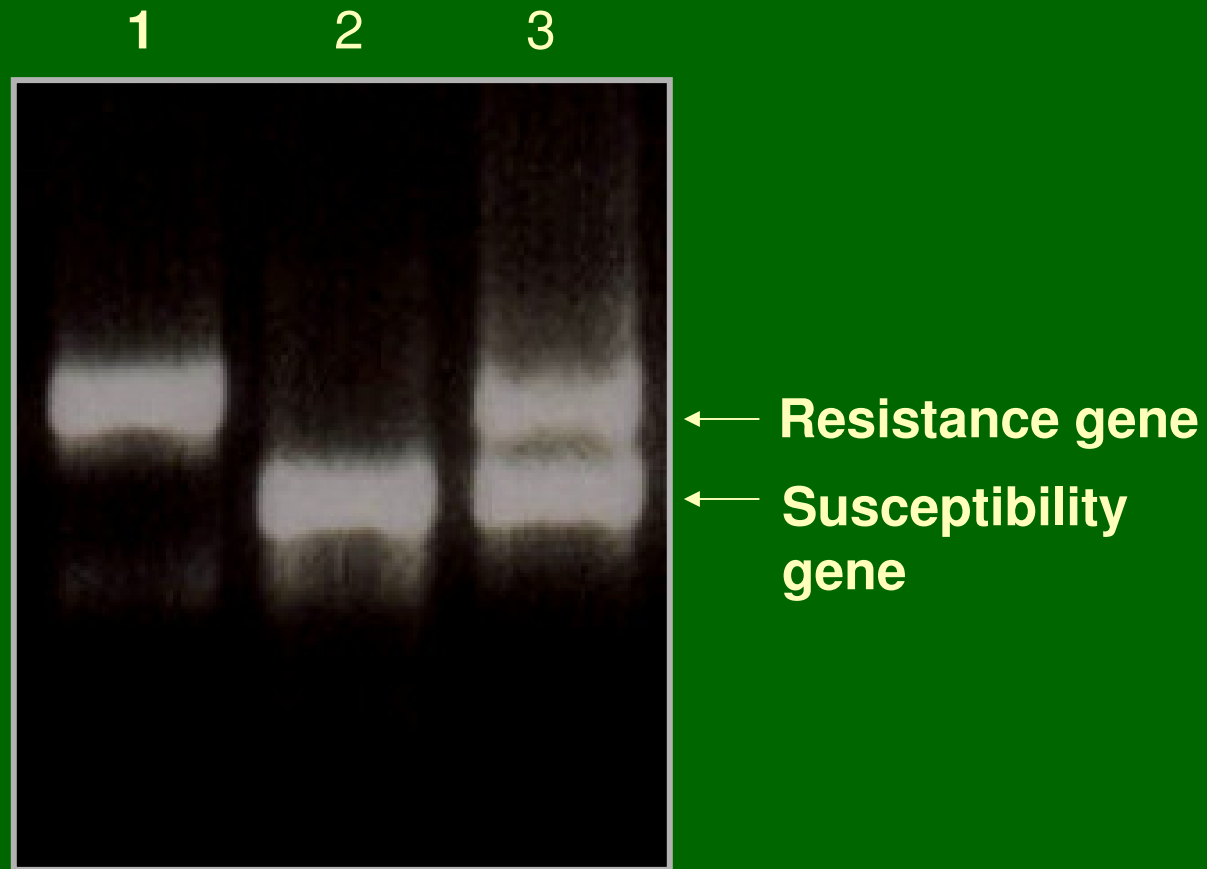
**Triguna
Insect Resistant,
Disease
Susceptible**

**Molecular
Breeding**

**Improved Variety:
Fine Quality,
Disease Resistant**

**Improved Variety:
Insect Resistant,
Disease Resistant**

DNA test for a rice resistance gene



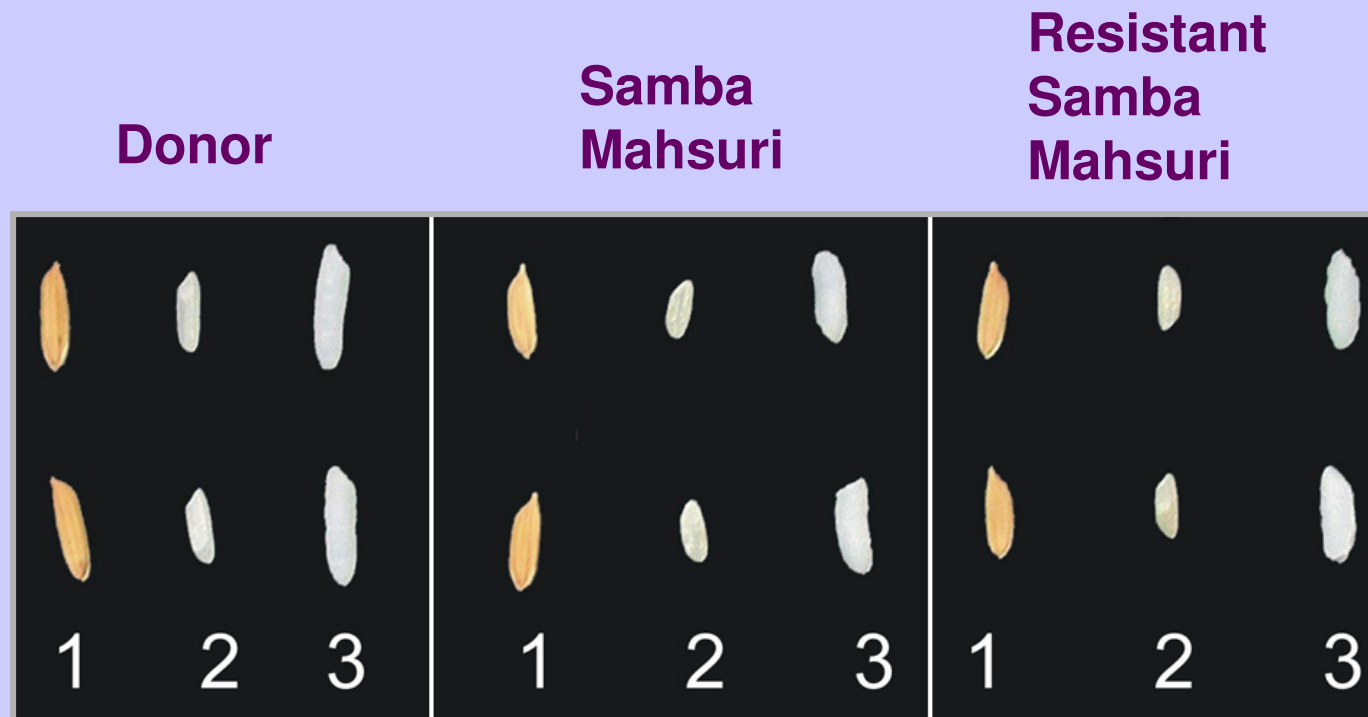
1 = resistant variety ; 2 =susceptible variety; 3 = Progeny

**Samba
Masuri**



**All derived
lines are
resistant**

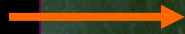
Grain characteristics of resistant lines are similar to Samba Mahsuri parent



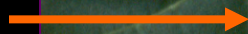
1 = Paddy; 2 = milled rice; 3 = cooked rice

The proof of the pudding is in the eating

Donor



Samba
Masuri



Resistant
Samba
Masuri



- **These lines have successfully undergone National field trials**
- **One of the resistant lines has been released for commercial cultivation**
- **This variety is currently being cultivated by farmers who are very appreciative of the variety**

- **Marker assisted selection (MAS) is a technology that really works**
- **The products can be taken to market without long delays caused by regulatory requirements**
- **However, MAS can only be applied to those traits for which the variation is already available in the gene pool of the organism**

Need of the hour:

Developing new technologies for increasing the extent of variation that exists within the gene pool of the organism

This will allow MAS to move into the application space for which options are currently available only through use of transgenics

Concerted efforts backed by generous government funding are needed

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Extending the scope of MAS

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Thank you

Grain from resistant lines is similar to Samba Masuri parent



Resistant
Samba Masuri



Samba
Masuri



SS1113

Milled rice from resistant lines is similar to Samba Masuri parent



Resistant
Samba Masuri



Samba
Masuri

SS1113