The Use of DNA Markers in Breeding for Improved California Rice Varieties

INTRODUCTION

The Rice Experiment Station (RES) uses traditionally the pedigree breeding method in rice cultivar improvement. Recently, DNA markers had augmented the breeding efforts in breeding rice for the different grain and market types.

The use of DNA markers has significantly helped the breeders in their selection for grain quality and disease resistance, and has played an important role in the advancement of the RES rice breeding program.

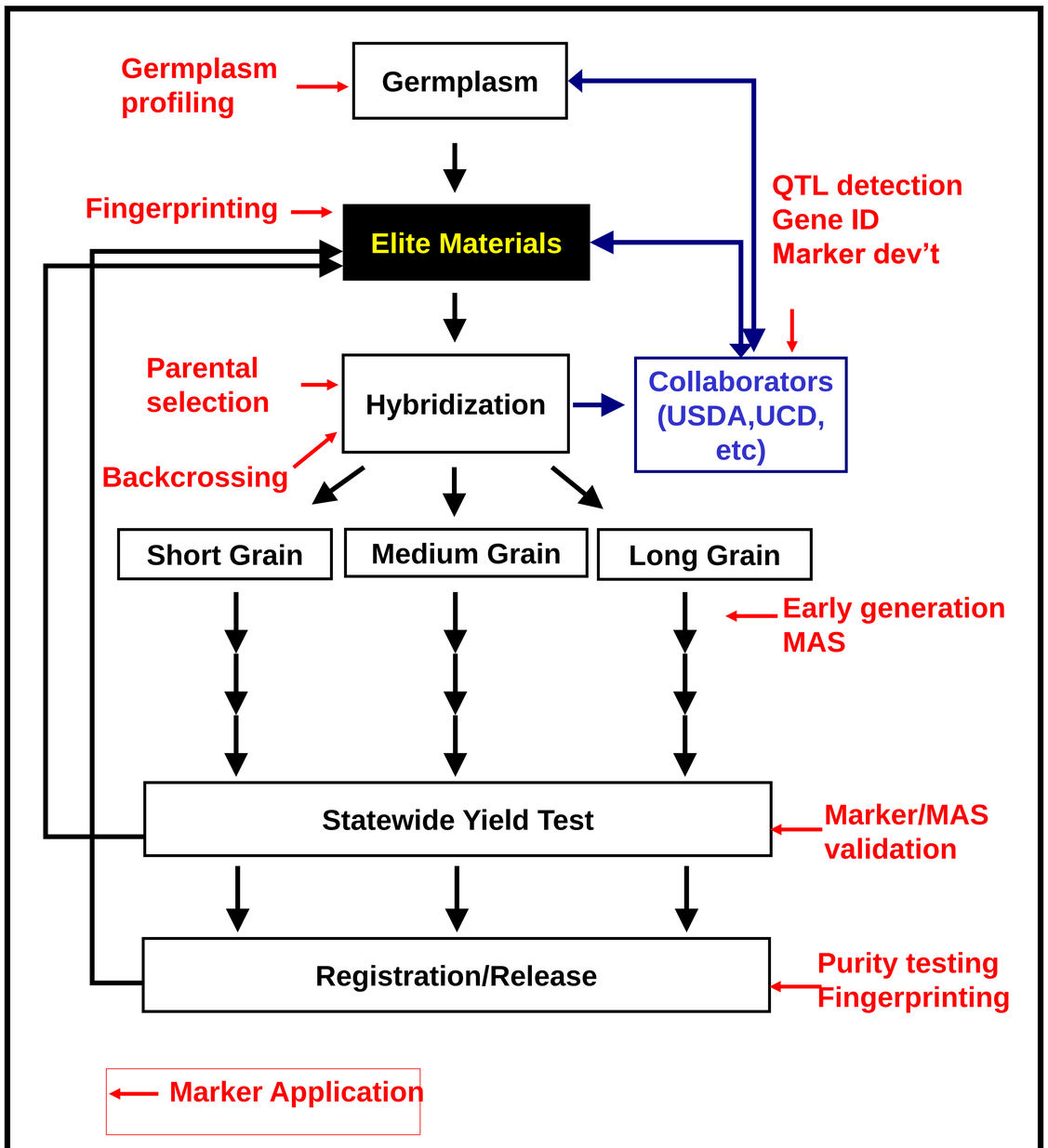


Diagram of the rice breeding program and DNA marker applications

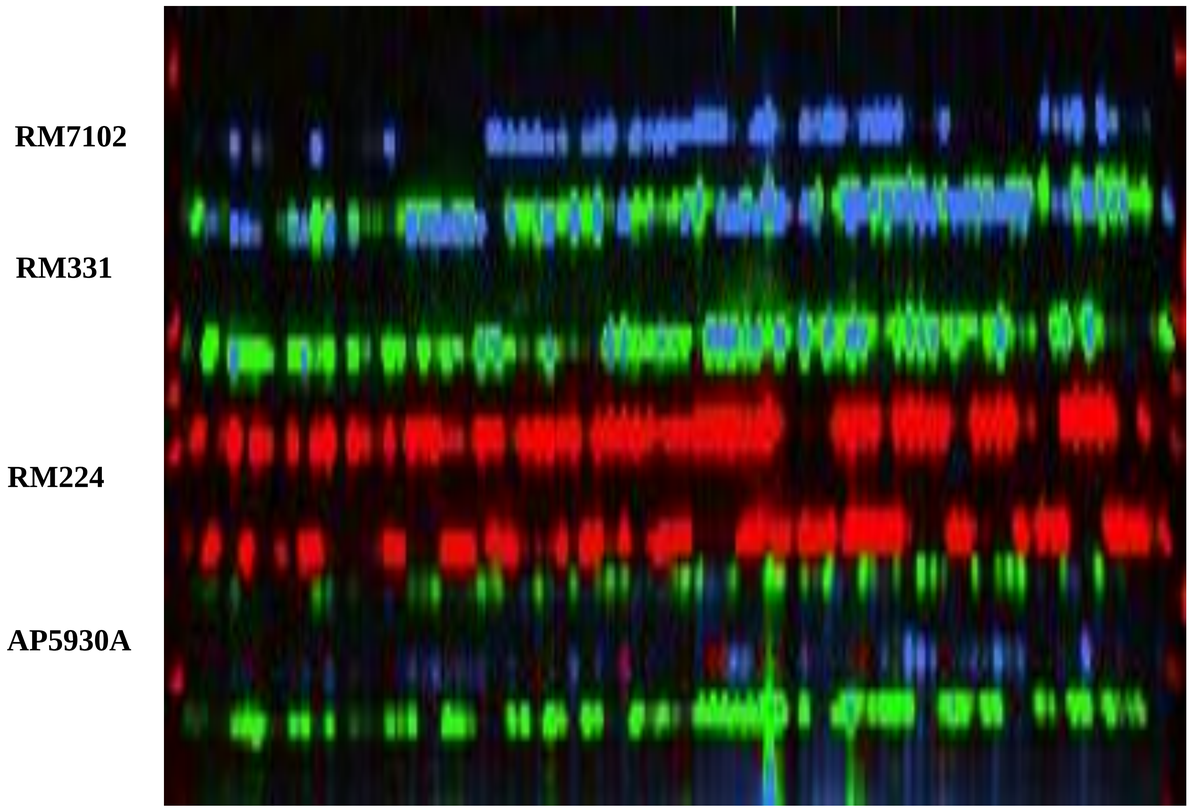
Breeding for Blast Resistance

A backcrossing program to incorporate four blast-resistance genes into M-206 background was initiated in 2005. The blast resistance genes from four donor parents and their respective chromosome locations are shown in the table below.

The marker-assisted selection for blast resistance resulted in the release of M-210 that has the blast resistance gene, *Pi-b*. These markers are now routinely used to breed for blast resistance.

Blast R genes and DNA markers for gene pyramiding

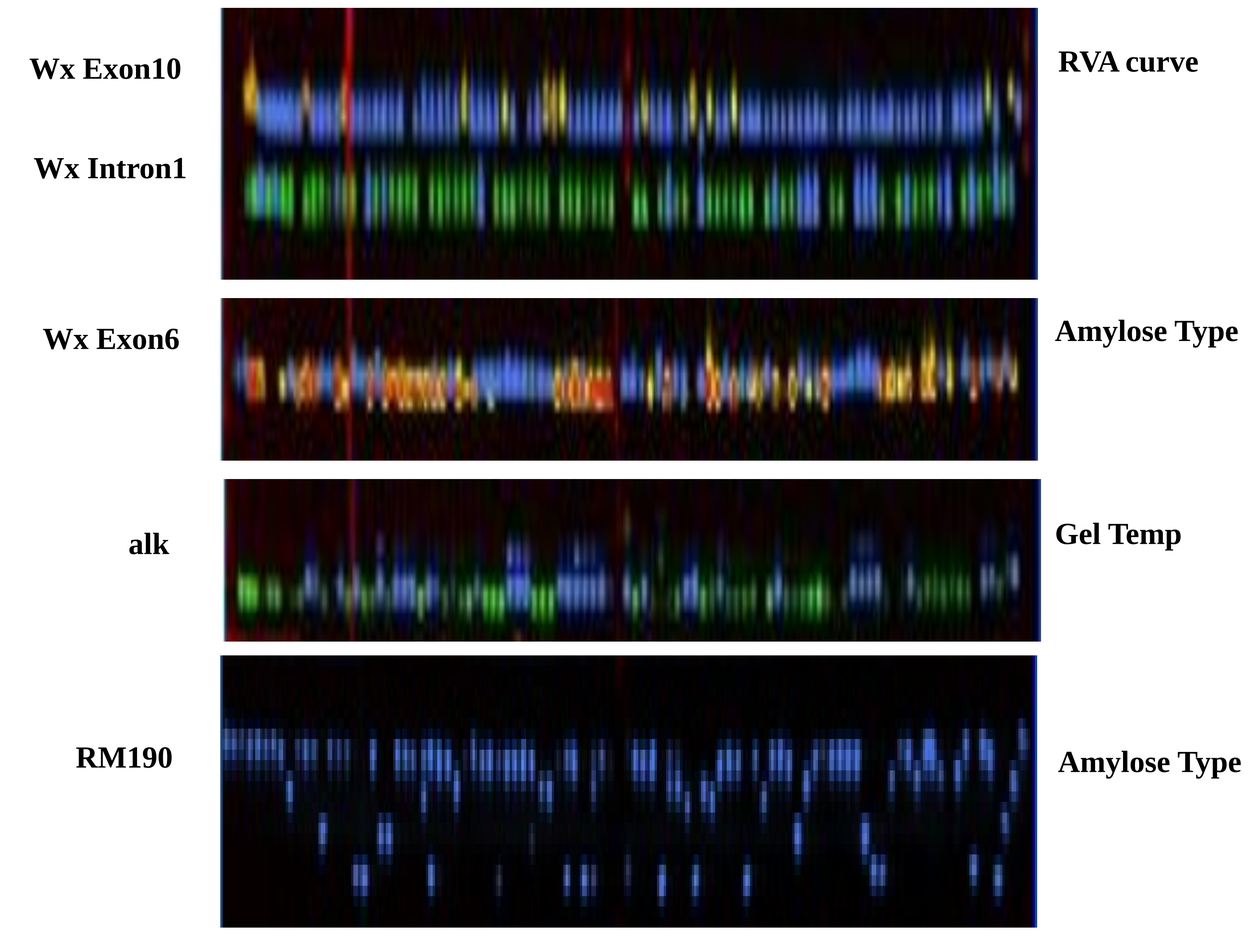
DNA Marker	Blast R gene	Donor Parent	Chrom. Location	Marker size in bp (Donor, M206)
AP5930A	Pi-40	IR65482	6	118,94
RM224	Pi-kh	Cocodrie	11	135,120
RM331	Pi-33	C101LAC	8	170,150
RM7102	Pi-ta2	Drew	12	190,160



SSR markers linked to various *Pi* genes

Breeding for Grain and Cooking Quality

The RES breeding projects aim to develop superior conventional and specialty varieties with outstanding agronomic characteristics and good cooking quality. Starting in 2009, advanced lines generated out of the breeding program had been routinely screened with a microsatellite marker for the waxy gene. Throughout the years, additional DNA markers were used routinely to screen for quality attributes. These markers assist breeders in predicting the amylose content and cooking quality thereby minimizing the need to cook thousands of entries for evaluation.



Markers used for determining grain quality in the LG project