

# Molecular Marker-Assisted Breeding in Durum Wheat

Harsh Raman<sup>1</sup>, Ray Hare<sup>2</sup>, Steve Simpfendorfer<sup>2</sup> and Rummana Rahman<sup>1</sup>

<sup>1</sup>NSW Department of Primary Industries, Wagga Wagga Agricultural Institute  
PMB, Wagga Wagga, NSW 2650, Australia

<sup>2</sup>NSW Department of Primary Industries, Tamworth Agricultural Institute, Calala,  
NSW 2340, Australia



Sumai-3 (6X) has been extensively used as a donor gene source for incorporating Fusarium Head Blight resistance in common wheat. Our preliminary results suggest that Sumai3 harbour genes for crown rot resistance and high polyphenol oxidase activity (PPO) that is implicated in the darkening of various end-products of common and durum (4X) wheat. To introgress the desirable alleles into durum wheat, an F<sub>2</sub> population derived from Sumai3 and Bellaroi was constructed and further evaluated for various traits of interest including crown rot resistance and polyphenol oxidase activity.

## Current Targets

- ❖ Resistance to Crown rot
- ❖ Low polyphenol oxidase activity
- ❖ Resistance to Fusarium head blight

## Marker Assisted Selection

Sumai-3 × Bellaroi



F<sub>1</sub>



F<sub>2</sub>

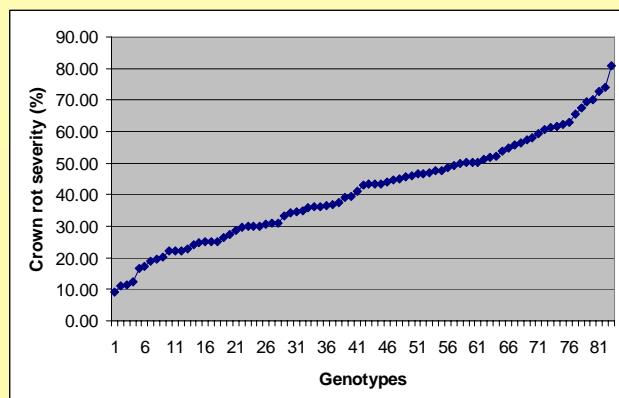
(Monitor gene introgression from hexaploid wheat using D genome specific markers & evaluation for resistance to crown rot)



F<sub>3</sub>

Evaluation for PPO activity using L- tyrosine, & molecular marker analyses

## Evaluation for Resistance to Crown rot in an F<sub>2</sub> Population



Our results on phenotyping indicate that genetic variation for crown rot resistance exists and seems to be heritable.

## Evaluation for Polyphenol Oxidase Activity

- PPO activity in wheat kernels were measured using the L-DOPA method (Raman et al 2005). Kernels were first scored visually, and the colour intensity of the supernatants was measured visually and in a spectrophotometer at 490 nm with a Milenia Kinetic Analyser (Molecular Devices, USA). Check genotypes were Arrivato (Durum, low PPO) and Excalibur (common wheat, high PPO).

## Molecular Marker Analysis

- **Polyphenol oxidase activity:** PPO is implicated in the time-dependant discolouration of various wheat and durum products. Previously, we mapped a major locus associated with PPO activity on the long arm of chromosome 2A (Raman et al 2005). Comparative mapping using wheat-rice synteny was used to develop a functional gene marker (Raman et al 2006).

Molecular markers that have shown linkage with PPO activity in common wheat were tested for their association in this population. Our results indicated that GWM312 and PPO18 markers were closely linked with PPO activity in Sumai3/Bellaroi population..

- **Fusarium Head Blight Resistance:** A major locus conferring FHB resistance has been mapped on the short arm of chromosome 3B using various markers. We utilised SSR markers for selection of 3BS region in the hybrid derivatives from Sumai3/Bellaroi population.
- **Mapping of crown rot resistance:** A framework map based upon SSR markers of Sumai3 and Bellaroi was also constructed using 35 SSR markers and subsequently employed for identification of QTL associated with crown rot resistance. Identified genomic regions associated with crown rot resistance are being validated.
- Genotypes having desirable alleles were selected and being progressed in the national durum breeding program

## Selected Reference:

- 1.Raman R, Raman H, Johnstone K., Lisle C, Smith A, Martin P and Allen H (2005) *Functional Integrative Genomics*. 5: 185-200
- 2.Raman R, Raman H and Martin P (2006). *Molecular Breeding* 19:315-328