

Use of molecular marker technology approach in wheat quality breeding

The yield enhancement of important cereals such as wheat and rice was the prime objective in green revolution and post green revolution period. After achieving success in this endeavor, the trend of wheat research all over the world has been to improve the quality of wheat for the end product use. Wheat is synonymous to the food security in the country and enhancing wheat quality will contribute greatly towards the food security as well as better quality wheat products. Quality of wheat is decided by the purpose for which it is meant and different species of wheat are grown for different products. For example, aestivum is grown for bread, chapati, biscuits etc. while durum wheat is grown for pasta products. The most important dimension is to increase the quality of Indian wheat by integrating DNA makers' technology in wheat breeding. It is, therefore, necessary to identify markers linked to the QTLs and to quantify the contribution made by each QTL to the phenotypic variation. It is also known that the environmental factors play role in the expression of these traits and hence multilocational testing of the RILs has been carried out in order to deal with the quality of wheat grain holistically.

Objectives:

- To analyze parental and recombinant inbred lines at multi-locations representing different agro-climatic conditions to study the effect of environmental factors in each case.
- To validate the identified markers in the same varietal background from where they were identified as well as in other varieties.
- To use the markers already developed for breeding of improved quality wheat.

Summary Achievements (August, 2004 to July, 2007)

Work done at DWR, Karnal

- Growing of bread quality RILs (175 for HI 977 X HD 2329 and 217 for CPAN X HD 2329) at three agro-climatically different locations viz. Karnal (NWPZ), Kota (CZ) and Pune (PZ) during 2004-05 and 2005-06.
- Analysis of RILs of both the crosses from all the three locations for various quality parameters like protein content, moisture content, hectolitre weight, sedimentation value, thousand grain weight, HMWGS and baking evaluation of bread.
- The adjusted values of various quality parameters were calculated from observed values following augmented design analysis and frequency distribution curves & dendograms for all the quality parameters were prepared to cluster the RILs based on quality parameters.
- Identification of molecular markers linked to the QTLs for bread making and also construction of framework maps in association with NCL, Pune.
- Testing of 1B/1R translocation in CPAN 3004 x HD 2329 population.
- Registration of MBL 2 and MBL 5 as genetic stocks at ICAR, New Delhi for high protein content

- A PCR- based diagnostic marker for HMWGS-8 was developed and was confirmed using large number of genotypes with and without HMWGS-8.
- The bread quality RILs (175 for HI 977 X HD 2329), grown at three agro-climatically different locations viz.
- Karnal (NWPZ), Kota (CZ) and Pune (PZ) during 2004-05 and 2005-06 crop seasons were assessed for various bread quality score components like Bread loaf volume (Max. Score 20.0), Stickiness (2.0), Appearance (2.0), Crust Colour (2.0), Crumb colour (3.0), Texture (4.0), Taste (2.0) and Aroma (2.0). The total score of 37.00 for various components was reduced to calculate the bread quality score out of 10.0.

Screening of HI 977 X HD 2329 population with

- 1Dx5, 1Dy10/Dy12 gene AS-PCR marker,
- Multiplex PCR marker
- GBSS1-7D gene,
- Pin a gene,
- Pin b-D1 gene its product with enzyme Bsr B1,
- Gpc-B1 gene related to bread quality
- Seven pairs of PCR primers for the identification of different Glu D3 gene haplotypes.
- Four primer pairs for bread wheat LMW-GS gene locus or allele-specific PCR markers for Glu A3
- Four primer pairs for wheat Y-gliadin gene locus or allele specific PCR primers

Work done in association with NCL, Pune

- Use of large number of STMS and ISSR primers for parental screening.
- Screening of whole population using polymorphic markers.
- Association of markers with various quality traits on different chromosomes.
- Ascertaining environmental interaction through differential accumulation of various gliadin proteins with the help of RP-HPLC.
- Construction of framework map and QTL analysis for bread making quality in wheat which included phenotypic analysis of bread loaf volume & bread quality score, framework map construction, QTL identification for bread quality score & bread loaf volume, effect of glutenin loci on bread quality score & bread loaf volume, implications of Q X E on bread making quality.

Use of Multiplex PCR for bread quality M-100 bp ladder 1.HI977x HD2329 population