

Improvement of industrial and nutritional quality of wheat

Improvement of industrial and nutritional of wheat is major concern of wheat breeding in India. Though major portion of wheat is consumed in the form of chapati, the demand of other industrial products as bread, biscuit, noodles, pasta products is increasing @ 6% per annum in India. The turn over of baking industry in India is estimated to be around 2.5 US Billion Dollars per annum. Wheat contributes major portion of nutritional security as well. Therefore, development of product specific varieties with enhanced nutritional quality has become important. This needs better understanding of genetic components related to various quality traits and their utilization in wheat improvement. Keeping these facts in mind several key research areas have been identified.

Major Research Areas

- Improvement of processing and nutritional quality of wheat
- Identification of germplasm lines having desirable quality traits
- To conduct basic research on molecular/genetic basis of wheat grain quality
- Development of molecular tools and their use in the breeding programme (MAS)
- Development of micro-level tests useful in prediction of quality of segregating lines
- Basic studies on starch biosynthetic pathway enzymes and genes for improving nutritional quality
- Evaluation of advance lines and quality component screening nursery for identification of superior cultivars for processing and nutritional quality traits

Major Achievements

- Germplasm lines having higher biscuit diameter and spread factor have been identified.
- Nap Hal, an Indian land race of wheat, has been characterized at molecular level in detail. Molecular analysis demonstrated that Nap Hal contains genes for weak gluten and soft grain characteristics suitable for biscuit making quality.
- Acid-PAGE analysis of more than 280 Indian wheat varieties released during last 100 years exhibited large genetic diversity
- The data demonstrated that SDS-PAGE and PCR based markers can be used in combination for identification of LMW glutenin alleles in wheat. This will help in correct identification of LMW glutenin alleles and their role in imparting gluten strength and extensibility.
- Grain hardness was studied extensively at molecular level and demonstrated the prevalence of null mutation in puroindolines in released varieties in India and having harder grains.
- Two puroindoline alleles namely pinB-D1r and pinB-D1s have been documented in International catalogue of wheat gene symbols 2005.
- Demonstrated the utility of microlevel tests, molecular markers in interclass hybridizations in wheat improvement.

- SRC profile along with protein content can be used in predicting Farinograph water absorption (FWA) as it explained 88% variability in FWA.
- It was established that SRC of 1 gram whole meal flour can be used in screening the recombinant lines in the breeding programme for biscuit making quality.
- Allelic diversity in granule bound starch synthase genes in Indian wheats and their relationship with starch pasting properties were assessed. PCR amplification of waxy genes demonstrated the presence of Wx-4A null mutants in large numbers of wheat varieties in India.
- Genome specific genes for Starch Synthase I (SSI) were characterized to develop genome specific primers for SSI. Primers were designed to amplify cDNA corresponding to starch synthase genes expressed during grain development in wheat.
- Allelic variations in the serpin genes encoded by Srp5Bb were assessed using CAP-PCR among the three hundred wheat varieties developed in India during the last 100 years. Majority of the varieties exhibited wild type allele (Srp5Ba).

Infrastructure development

Excellent facility has been developed for evaluation of chemical, rheological and baking quality. Main equipments available are as follows; Chopin Alveo-consistograph, Brabender Farinograph, National Mixograph, NIR for protein estimation, Glutamate, Single Kernel Characterisation System, Rapid Visco-amylograph (RVA), Texture analyzer, Brabender Quadrumet Senior Mill, Cyclotec Mills, Baking ovens, Dough mixers for bread and biscuit making, Semolina mill, Macaroni Extruder and equipments for electrophoretic studies of storage proteins and PCR products including centrifuges are also available. In addition, facility has being developed for analysis of micronutrients as Fe, Zn, Mn and Cu by AAS and amino acid by HPLC.

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