Thesis Abstract

Thesis title: "Molecular Breeding in Wheat for Drought Tolerance and Leaf Rust Resistance".

Summary: The present study in wheat was undertaken with the following three major objectives: (i) To introgress a major QTL for moisture stress conditions into high yielding Indian wheat cultivars using MAS and evaluation of derived lines.. (ii) To pyramid genes/QTLs for grain quality and rust resistance in wheat. (iii) To identify and study of expression analysis of SWEET gene family members in wheat under moisture stress in tolerant and sensitive genotypes. A summary of the material, methods, and results related to each of the above three objectives is as follows. In the first objective four Indian wheat cultivars, namely HUW234, HUW468, K307, and DBW17 were each used as the recipient parents with the common donor parent SQ1 (carrying the desirable QTL) for the introgression of drought insensitive yield QTL *Qyd.csdh.7AL* using marker-assisted back-cross breeding scheme. Based on foreground MAS and visual phenotypic selection for desirable traits, 55 lines (28, 12, 8, and 7 plants involving HUW234, DBW17, K307, and HUW468, respectively), each carrying the marker associated with the desired QTL in homozygous condition were selected. Of these 55 MAS-derived lines 17 lines have been selected which were high yielding under drought. In the second objective two improved wheat lines, namely PBW343 Unnat (*Yr70/Lr76+Lr37/Yr17/Sr38*) with ambar grain color and PBW343 (*Gpc-B1/Yr36+QPhs.ccsu-3A.1+QGw.ccsu-1A.3+Lr24/Sr24+Glu-A1-1/Glu-A1-2*) with red grain color, were intercrossed to pyramid genes/QTLs for grain quality and rust resistance. Following MAS, 39 plants were selected in the F_3 generation, which carried all the desirable genes/QTL in homozygous condition, except the two HMW-glutenin genes *Glu-A1-1/Glu-A1-2*, which were tested in the F_4 generation. These plants were selfed and F_4 progenies/lines were derived. Twenty three (23) of the 39 F_4 lines were also found to be positive for two HMW-glutenin genes, namely *Glu-A1-1/Glu-A1-2*. Of these 39 MAS derived lines 12 lines showed significantly higher grain protein content (GPC) (0.7-2.1%) without any grain yield (GY) penalty. Four MAS-derived lines had significantly higher GY with no penalty for GPC. In the third objective, a total of 108 genes were identified, which could be arranged in 17 types available in Arabidopsis. As many as 98 of 108 genes were assigned to 21 individual chromosomes. Ten genes had very high expression in five tissues and 15 stages (FPKM>40). As many as 29 genes (examined for expression analysis) responded to water and heat stress and exhibited high expression (FPKM ranging from 2.05 to 470). These genes were validated using qRT-PCR under drought, heat, and leaf rust infection.

Tinku Gautam

Tinku Gautam
(Student)

PKS

Prof. PK Sharma
(Supervisor)

Dr. P.K. SHARMA
Professor
Department of Genetics & Plant Breeding
Ch. Charan Singh University
Meerut-250004