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Objectives of the current proposal are to: 1) Evaluate the effectiveness of haplotype selection in pyramiding multiple FHB QTL via marker assisted selection for FHB-resistant genotypes; 2) Develop adapted parents and/or cultivars with combined multiple FHB resistance QTL; 3) Characterize QTL conferring FHB resistance in the soft red winter (SRW) wheat native source Massey and; 4) Evaluate FHB resistance in barley germplasm. Two populations will be evaluated and characterized for FHB resistance QTL in the current study. The first population was derived from a three-way cross comprised of adapted SRW wheat parents having complementary and known FHB resistance QTL-markers. Progeny of this population will be evaluated, selected and advanced over three generations via marker assisted selection of desirable haplotypes for 17 markers in five known FHB QTL regions (chromosomes 2DS, 3AS, 3BS, 5AS, and 6B) having association with type I, II, and DON resistance identified previously in exotic and native sources. Selected F₄ lines will be evaluated for type II resistance in a greenhouse test using floret inoculation and simultaneously characterized for type I, type II, FDK, and DON resistance via evaluation in an inoculated, mist irrigated field nursery at Blacksburg, VA. In addition, the F₄ lines also will be evaluated for agronomic type and reaction to other prevalent diseases in a headrow test at Warsaw, VA. Over 40,000 data point will be produced in the haplotyping study over the three generations. Effectiveness of MAS and reliability of target marker haplotypes in predicting overall FHB resistance will be determined via analysis of marker haplotype data with greenhouse and field FHB phenotypic data, including disease severity, incidence, %FDK and DON concentration. The expected outcome is to provide breeders with useful genetic materials and selection protocols including adapted FHB resistant germplasm and/or cultivars and ideal selectable marker haplotypes of multiple QTL for use in MAS pyramid breeding.

The second population comprised of 175 F₁₃ recombination inbred lines (RILs) derived from a cross between SRW wheat cultivars Becker and Massey will be used to characterize Massey's novel FHB resistance. Massey, developed and released by Virginia Tech in 1981 is a unique cultivar in that it has been documented to possess durable adult plant resistance to powdery mildew which has remained effective for 25 years. Massey also has consistently exhibited high levels of FHB resistance and low DON levels and preliminary haplotyping studies indicate that Massey possesses known FHB resistance marker alleles (STS3B-142, FHB01, Gwm493) in the 3BS and (Barc45, Gwm674) 3AS QTL regions. FHB resistance in Massey will be initially characterized via haplotyping of 21 markers for the 5 known FHB QTL. The 175 RILs will be evaluated in two greenhouse and two field studies to assess type I, type II, FDK and DON resistance during 2006 to 2008 crop years. Characterization of FHB resistance in this potentially novel adult plant resistance source is of significance in the identification and directed use of diverse resistance genes in native sources.

FHB resistance in 30 winter barley lines initially selected in disease screening tests at the University of Minnesota will be further evaluated in an inoculated, mist irrigated FHB nursery at Blacksburg, VA. These lines will be assessed for FHB incidence and severity in the field, and grain samples will be harvested if feasible and desired for DON analysis.