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Project Title: Improvement of Soft Winter Wheat that is Resistant to FHB and Adapted to Indiana.

PROJECT 1 ABSTRACT

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Objectives: 1) develop adapted soft winter wheat cultivars that have low-FHB incidence, type I and/or type II resistance, low DON, and resistance to other important diseases, 2) phenotype wheat lines in regional nurseries and lines in Purdue performance nurseries for FHB resistance, and genotype parent lines for combinations of FHB resistance QTLs, 3) conduct prebreeding/genetic analysis of FHB resistance from *Th. ponticum*, and phenotype FHB type I and type II resistance of closely-related lines in winter wheat backgrounds that have combinations of FHB resistance QTL, determined by associated marker genotyping.

F₁ populations are vernalized in summer, grown in a greenhouse August – October, and F₂ populations are seeded at Evansville, IN about November 1. We make 400+ crosses annually. Essentially all of our current early-generation populations have one or multiple QTL for FHB resistance. Our parent lines that have these QTLs (with published markers) and Ernie, Bess and Truman, without markers, so we backcross one or more cycles to Ernie, Truman, and Bess, and simply phenotype for resistance plus genotype for QTL from the above parental donors. Several diseases, including FHB, are significant most seasons at Evansville, so effective selection in F₂. We also submit grain samples for DON analysis. At Lafayette we grow plots of the NUWWSN and PNUWWSN, and all entries in regional performance nurseries, many of the commercial varieties in Indiana, and all entries in our IN multilocation yield nursery and preliminary yield nursery are seeded in disced corn residue and misted at 7-10am and 5-8pm on non-rainy days from 3 weeks prior to heading to 2 weeks after heading. For point inoculation: we inoculate a basal floret of the third spikelet from the tip of the spike with 500 *F. graminearum* macro spores in 10 ul dH₂O with a dispensable syringe, then cover the spike with a clear plastic bag for 3 d, and at 21 – 24 dai (depending on weather conditions and disease development in a given season) determine the number of infected spikelets from the point of inoculation toward the base of the spike. By covering the spikes for 3 d, we have noted no or little natural infection to confound disease readings.

Prebreeding/genetic analysis of novel FHB resistance: we are backcrossing the QTL *Qfhs.pur-7EL* into adapted soft winter wheat lines, and we are field testing a number of these lines in 2009. We will phenotype different combinations of FHB resistance QTL - we have developed by backcrossing and marker genotyping, combinations of multiple FHB resistance QTL. In the greenhouse, spring 2009, we are genotyping and point inoculating F₄ families from BC₁₋₃-derived plants that were grown in the field in 2008 and genotyped with markers and phenotyped by point inoculation and natural infection. We are repeating tests documenting that *Qfhs.pur-7EL* augments resistance of other resistance QTL/genes. And when *Qfhs.pur-7EL* and *Fhb1* are combined the disease essentially does not spread to other spikelets after point inoculation, in tests in the greenhouse and field.