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Project Title: Genetic Characterization and Integrated Deployment of FHB Resistance in Spring Wheat

PROJECT 3 ABSTRACT

(1 Page Limit)

In previous studies, we identified and mapped two QTL (*Qfhb.rwg-5A.1* and *Qfhb.rwg-5A.2*) for FHB resistance on chromosome 5A of PI 277012. Further fine mapping of the major QTL on 5AL (*Qfhb.rwg-5A.2*) has delimited it in a genomic interval of ~300 kb and a number of SNP markers have been identified in this region based on genome sequencing of PI 277012 and comparison with the reference genome of Chinese Spring. Individual BACs covering the genomic region were identified and FHB susceptible EMS mutants were identified from PI 277012. Our overall goal is to clone and characterize this QTL and quickly deploy it in the four spring wheat breeding programs of the Spring Wheat Coordinated Project (SPR-CP). Therefore, the pre-proposal will include the following objectives:

- 1) Clone and characterize the major FHB resistance QTL *Qfhb.rwg-5A.2* in the wheat line PI 277012.
- 2) Quickly introgress *Qfhb.rwg-5A.2* and *Fhb1* into elite spring wheat cultivars and breeding lines by backcrossing, marker-assisted selection and speed breeding approach.
- 3) Determine the expression of *Qfhb.rwg-5A.2* and its interaction with *Fhb1* in different genetic backgrounds.

With the sequences of BAC clones, we will build up a BAC sequence contig for the QTL region and identify candidate gene(s) for the FHB resistance. The candidate gene(s) will be verified using EMS mutants, CRISPR-Cas9 gene editing and plant transformation. In the meantime, we aim to introgress the major QTL (*Qfhb.rwg-5A.2* and *Fhb1*) into elite spring wheat cultivars or breeding lines selected by four spring wheat breeding programs in the SPR-CP through backcrossing, marker-assisted selection, and speed breeding approach. Near-isogenic lines with a single QTL (*Qfhb.rwg-5A.2* or *Fhb1*) or a combination of the two QTL will be developed and evaluated for FHB resistance with the purpose to determine the expression of *Qfhb.rwg-5A.2* and its interaction with *Fhb1* in various genetic backgrounds. Cloning and characterization of *Qfhb.rwg-5A.2* will provide information regarding the molecular mechanism of FHB resistance and accelerate the development of wheat varieties with improved FHB resistance by gene-specific marker assisted selection and gene pyramiding. Elite near-isogenic lines of spring wheat with the major FHB resistance QTL will be generated and can be directly used by the wheat breeders to develop FHB resistant varieties with the ultimate goal of reducing the impact of FHB in wheat production.