Project Abstract

Project Title:	**Transfer of FHB Resistance to NDSU Hard Red Winter Wheat Breeding Material**	
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The project develops FHB resistant material for the NDSU winter wheat breeding program. Inadequate resistance in NDSU winter wheat germplasm made it necessary to introduce specific, validated FHB resistance QTL from exotic sources. Those exotic QTL include: *Fhb1* (3BS) and *Qfhs.ifa-5A* (5AS) from CM82036; *Qfhb.rwg-5A.1* (5AS) and *Qfhb.rwg-5A.2* (5AL) from PI277012; *Fhb6* (1AS) from TA5660; *Fhb7* on 7BL of XWC14-255-3-1 (new) and QTL2DL ex Wuhan-1 (new). Based on their different chromosome locations, these exotic QTL are likely to be non-orthologous genes with different resistance mechanisms that will diversify and raise resistance levels and thus buffer against new and evolving pathogen virulence. Unavoidably, the donor material also contributes sub-optimal agrotype and lacks in adaptation genes and resistance to other wheat diseases, requiring carefully planned breeding to develop more versatile and genetically varied breeding stock. When incorporating such new, strong-effect resistance QTL into wheat germplasm, higher levels of effective resistance is achieved when the recipient material already has a level of “native” or “background” FHB resistance. Thus, it is important to also breed for recipient genetic backgrounds that will contribute native resistance. Commercially, the benefit from new FHB resistant cultivars can be increased further with judicious fungicide application, making it advisable to also evaluate the response of new, resistant genotypes to chemical applications. Ultimately, the project aims to breed productive, winter-hardy varieties with durable resistance to FHB that consistently produce high quality seed with low DON content. Specific project objectives are:

1. Systematically raise the frequencies of the targeted, exotic FHB resistance genes within the HRWW breeding program. Crossbreed and select to also attain multiple disease and pest resistance, increased winter-hardiness, productivity and processing quality. Evaluate progenies under appropriate biotic stress conditions and utilize marker-aided breeding to facilitate identification of desirable plants.
2. Identify and breed lines with useful levels of native/background resistance to FHB. Such lines can be used in crosses to supplement and enhance the contributions from exotic resistance. Combining ability tests based on diallel and test crosses will be used for the discovery of lines with significant native resistance.
3. Employ routine single seed descent (SSD) inbreeding for more rapid generation advance. This will be done for promising cross combinations to accelerate the development of resistant cultivars.
4. Conduct an annual Winter Wheat x Fungicide performance field trial. Evaluate the response of advanced breeding lines and controls to fungicide application and determine the effect on yield and DON content.