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Research Category: **HWW-CP** **Duration of Award: 1 Year**

Project Title: Enhance Variety Development of Scab Resistant Hard Winter Wheat Varieties in Nebraska.

PROJECT 1 ABSTRACT

(1 Page Limit)

The wheat production in eastern and central Nebraska is an important component of our primary corn-soybean and corn-wheat rotations, however, scab and its related mycotoxins (e.g. DON) have made wheat (the scab prone region is estimated to be 800,000 acres) the least reliable/predictable crop in eastern and central NE. There is a great need for cultivars with improved scab resistance coupled with improved management to reduce the detrimental effects of scab and DON. The main approaches will be: 1. Use our scab mist nurseries to identify lines with improved scab tolerance and reduced DON with: a) native resistance (e.g. Overland, Lyman, Everest, Art, SY Wolf, Hitch, and new experimental lines), b) known major Fhb tolerance QTLs (e.g. the Wesley and Overland *Fhb1* isolines, the Bakhsh *Fhb1* lines, the soon to be developed doubled haploid lines with *Fhb1*, and other new lines from our breeding program, etc.), 2. Use designed crosses and molecular markers to introgress and pyramid known QTLs (Fhb1, Fhb3, 5As, etc.) in native resistance backgrounds, and 3. Advance lines through a full range of agronomic, scab and other disease, winter hardiness, and end-use quality tests. We will continue to improve our scab screening capabilities and to screen our preliminary (300 lines), intermediate (60 lines) and elite nurseries (60 lines) in replicated FHB screens, as well as, the lines in the collaborative scab evaluation trials. DON is measured on all the advanced and elite trials. The data from this screen and from our greenhouse screen (60 lines/year) will be added to our database to create a history of DON responses. We normally identify 10 to 15 lines per year with superior native resistance. These lines will be crossed to adapted elite and backcross lines with known Fhb alleles and QTLs (e.g. Wesley *Fhb1* and Overland *Fhb1*). We will make 75 crosses each year specifically for this project. The segregating progeny of these crosses will be screened with molecular markers to enrich the proportion of Fhb alleles and QTLs. They will be advanced through our normal breeding procedure (estimated to be 75 F_2 bulks, 75 F_3 bulks, 5000 headrows, 200 observation plots, 30 preliminary lines annually; the number of lines in the intermediate and elite nurseries will depend upon DON level and agronomic performance) to select for the additional traits that are needed. The elite lines will be tested and compared to existing cultivars with the understanding that reduced DON will be a key trait in the release decision and that many currently grown cultivars are too high in DON. As elite lines and cultivars are identified, we will put them into the cultivar by fungicide trials to determine the level of improvement fungicides and management can add to the genetic resistance. To enhance this effort we will work closely with the efforts of Dr. Guihua Bai to evaluate the best lines from his backcrossing program for scab tolerance, low DON, and adaptation. We will also initiate/collaborate with Dr. Bai to create additional backcrossing and DH populations as we identify lines adapted to eastern and central Nebraska. We will also continue testing new FHB alleles from Dr. Gill's efforts and determine if they have pleiotropic effects on agronomic performance in our environments. We will continue our work with Floyd Dowell on improved sorting technology to remove unwanted kernel types in segregating populations and to develop objective FHB assays. We expect to continue to release cultivars with lower DON through: 1) our native resistance (e.g. Overland [syn NE01643], McGill, etc.), and 2) our use of single and pyramided QTLs for known FHB QTLs.