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PROJECT 2 ABSTRACT
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Native FHB resistance in cultivated wheat has been widely explored and utilized in wheat breeding. There is an urgent need of additional resistance sources to strengthen and diversify the defense of spring wheat and other classes of US wheats to FHB. One of the strategies to achieve that goal is to search for novel resistance genes from wheat-related wild species and incorporate them into wheat. Here, we propose to identify and develop wild relative-derived wheat materials with FHB resistance and to incorporate alien resistance genes into wheat for germplasm development. Also, we will characterize the alien resistance genes and develop user-friendly molecular markers to assist selection of FHB resistance in wheat breeding. An effective meiotic homoeologous recombination-based gene introgression approach we recently developed will be used to achieve the goal. The specific objectives of this project are to:

1) Incorporate alien FHB resistance genes into adapted spring wheat genotypes;
2) Characterize the alien chromatin containing FHB resistance genes incorporated into the wheat genome and minimize linkage drag associated with resistance genes; and
3) Develop FHB-resistant germplasm immediately usable in spring wheat breeding.

We have developed and collected a large number of wheat-alien species derivatives involving multiple wild species. Non-*Fhb1* resistance has been identified from the derivatives and utilized for germplasm development in spring wheat. To date, we have provided over 200 breeder-friendly spring wheat germplasm lines with FHB resistance and various agronomic traits to the spring wheat breeding programs for variety development. Additional FHB resistance sources have been identified from the wheat-alien species derivative pool. We will characterize those resistance sources and incorporate them into adapted spring wheat backgrounds. Chromosome manipulation, if necessary, will be performed to minimize deleterious effects associated with alien chromatin. The introgression materials at early generations will be evaluated to select FHB-resistant segregants under greenhouse environments. Advanced introgression lines will be evaluated for FHB resistance and other agronomic traits under field conditions in ND and China. The FHB-resistant introgression lines will be submitted for DON testing. We anticipate developing additional elite spring wheat germplasm with FHB resistance and low DON accumulation from these wild species-derived resistance sources. Breeder-friendly alien introgression lines with FHB resistance and potentially reduced DON will be made available immediately to the spring wheat breeding programs for variety development as we usually do. This will strengthen and diversify resistance of spring wheat to FHB.