Project Abstract

Project Title:	Recurrent selection to improve FHB resistance in durum wheat	
Principal Investigator:	Xuehui Li	Department of Plant Sciences, NDSU
Co-Investigator:	Elias Elias	Department of Plant Sciences, NDSU
Co-Investigator:	Shaobin Zhong	Department of Plant Pathology, NDSU

In USA, durum wheat is primarily grown in the Northern Great Plains. Fusarium head blight (FHB) is the most destructive fungal disease that reduces the durum wheat production and end-use quality in this region. The overall goal of this project is to develop durum wheat germplasm with a high level of FHB resistance that can adapt to the Northern Great Plains. For a complex quantitative trait like FHB resistance, integration of favorable alleles of the involved genes - even of minor effect - promises to provide high and stable resistance. Genomics-assisted recurrent selection can be utilized to accelerate the process and thus facilitate the development of FHB resistant germplasm.

The specific objectives of this project are to: (1) improve FHB resistance through recurrent phenotypic selection in a durum wheat population and (2) develop genomic selection (GS) model and utilize GS to accelerate genetic improvement of FHB resistance. We have performed three cycles of phenotypic selection from 2019 to 2021. In each cycle, 150 S1 families were evaluated at two locations and the top 15 families were selected and intercrossed to generate the next cycle population. In this project, we plan to conduct four additional cycles of phenotypic selection from 2022 to 2026. We also aim to implement genomics-assisted recurrent selection to accelerate genetic improvement in this population. An initial GS model will be developed using the phenotypic and genotypic data collected from the first four cycles of the populations. In 2024, we will conduct three cycles of GS and evaluate its selection efficiency in 2025 and 2026 by comparing it to phenotypic selection. By 2026, we expect to develop some durum wheat S1 families and/or inbred lines with better FHB resistance than the current best durum cultivar "Riveland" and with acceptable grain yield, which can be utilized in durum breeding programs for new cultivar development.

This project as a pre-breeding program will continuously provide breeders FHB resistant germplasm through recurrent selection. The resulted populations can be also used for genetic dissection study of FHB resistance in durum wheat.